Government of the People's Republic of Bangladesh
Bangladesh Water Development Board

9

River Training Studies of the Brahmaputra River

Master Plan Report

1994

Technical Annexes
Annex 6
Tender Documents

Volume 1
Instructions to Bidders
General Conditions of Contract
Conditions of Particular Application
Specification
Drawings

Sir William Halcrow & Partners Ltd.
in association with

Danish Hydraulic Institute
Engineering & Planning Consultants Ltd.
Design Innovations Group

HALCROW

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Sir William Halcrow & Partners Ltd has prepared this report in accordance with the instructions of the Bangladesh Water Development Board for their sole and specific use. Any other persons who use any information contained herein do so at their own risk.

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FOREWORD

The BRTS Master Plan Report was issued on 28 June 1993. Comments from BWDB and FPCO were received from July 1993 onwards, and responses to those comments were issued in a single volume on 7 March 1994. The report was approved at the 20th FAP Technical Committee Meeting on 9 August 1994 subject to certain amendments. The amendments have duly been incorporated and the report was reissued in its present form in December 1994.

RIVER TRAINING STUDIES OF THE BRAHMAPUTRA RIVER

MASTER PLAN REPORT

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GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH

BANGLADESH WATER DEVELOPMENT BOARD

BRAHMAPUTRA RIGHT BANK PHASE 1 WORKS
CONTRACT NO. <no. & title>

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<information for tenderers; to be compiled for each contract on completion of hydrological and riverflow studies, geotechnical investigations, bathymetric and topographic surveys, etc.>

BRAHMAPUTRA RIGHT BANK PHASE 1 WORKS

SECTION 1: INSTRUCTIONS TO BIDDERS

INSTRUCTIONS TO BIDDERS

A. General

1. Scope of Bid

1.1 The Bangladesh Water Development Board, hereinafter "the Employer", wishes to receive bids for the construction and completion of the Brahmaputra Right Bank Phase 1 Works, Contract No. <no. & title> comprising the construction of 300 m long "hard point" revetments at <location> and <location> with upstream and downstream terminations, as defined in these bidding documents, hereinafter referred to as "the Works".

1.2 The successful bidder will be expected to complete the Works within 24 months from the date of commencement of the Works.

1.3 Throughout these bidding documents, the terms "bid" and "tender" and their derivatives (bidder/tenderer, bid/tendered, bidding/tendering, etc.) are synonymous, and "day" means calendar day.

2. Source of Funds

2.1 The Government of the People's Republic of Bangladesh has applied for credit from the <**funding agency**> in various currencies equivalent to US$ <.....> towards the cost of the Project and intends to apply part of the proceeds of this credit to eligible payments under the contract (hereinafter referred to as the Contract) for which this invitation to bid is issued.

Payment by <**funding agency**> will be made only at the request of the borrower and upon approval by the <**funding agency**> in accordance with the Credit Agreement, and will be subject in all respects to the terms and conditions of that Agreement. Except as the <**funding agency**> may specifically otherwise agree, no party other than the borrower shall derive any rights from the Credit Agreement or have any rights to the credit proceeds.

Note: < > means insert as appropriate prior to issue

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3. **Eligible Bidders**

3.1 This invitation to bid is open to any bidder meeting both of the following requirements:

(a) a bidder (including all members of a joint venture and all subcontractors of a bidder) shall be from an eligible source country as defined under ‹**funding agency guidelines**› and

(b) a bidder (including all members of a joint venture and all subcontractors of a bidder) shall not be affiliated with a firm or entity

(i) which has provided consulting services during the preparatory stages of the Works or of the project of which the Works form a part, or

(ii) which has been hired (or is proposed to be hired) as Engineer for the Contract.

3.2 Bidders shall provide such evidence of their eligibility satisfactory to the Employer as the Employer shall reasonably request.

4. **Eligible Materials, Equipment, and Services**

4.1 The materials, equipment, and services to be supplied under the Contract shall have their origin in eligible source countries, defined under ‹**funding agency guidelines**› and all expenditures made under the Contract will be limited to such materials, equipment, and services. At the Employer's request, the bidder having offered the lowest evaluated bid may be required to provide evidence of the origin of materials, equipment, and services satisfactory to the Employer.

4.2 For purposes of Clause 4.1 above, "origin" means the place where the materials and equipment are mined, grown, produced or manufactured, and from which the services are provided.

5. **Qualification of the Bidder**

5.1 To be qualified for award of Contract, bidders shall:

(a) submit a written power of attorney authorizing the signatory of the bid to commit the bidder;

(b) update the following information submitted with their applications for prequalification, and continue to meet the minimum threshold criteria set out in the prequalification documents;

i) average annual turnover in construction work;

ii) evidence of access to lines of credit, and availability of other financial resources;

iii) financial predictions for the current year and the two following years, including the effect of known commitments;

iv) contract work in hand;

v) current litigation.

5.2 Bids submitted by a joint venture of two or more firms as partners shall comply with the following requirements.

(a) the bid shall include all the information listed in Sub-Clause 5.1 (a) and (b) i) to v) above for each joint venture partner;

(b) the bid, and in case of a successful bid, the Form of Agreement, shall be signed so as to be legally binding on all partners;

(c) one of the partners shall be nominated as being in charge, and this authorization shall be evidenced by submitting a power of attorney signed by legally authorized signatories of all the partners;

(d) the partner in charge shall be authorized to incur liabilities and receive instructions for and on behalf of any and all partners of the joint venture and the entire execution of the Contract including payment shall be done exclusively with the partner in charge.

(e) all partners of the joint venture shall be liable jointly and severally for the execution of the Contract in accordance

with the Contract terms, and a statement to this effect shall be included in the authorization mentioned under (b) above as well as in the Form of Bid and in the Form of Agreement (in case of a successful bid); and

(f) a copy of the agreement entered into by the joint venture partners shall be submitted with the bid.

5.3 Bidders shall also submit proposals of work methods and programme, in sufficient detail to demonstrate the adequacy of the bidders' proposals to meet the technical specifications and the completion time referred to in Sub-Clause 1.2 above.

6. **One Bid Per Bidder**

6.1 Each bidder shall submit only one bid either by himself, or as a partner in a joint venture. A bidder who submits or participates in more than one bid (other than alternatives pursuant to Clause 18) will be disqualified.

7. **Cost of Bidding**

7.1 The bidder shall bear all costs associated with the preparation and submission of his bid and the Employer will in no case be responsible or liable for those costs, regardless of the conduct or outcome of the bidding process.

8. **Site Visit**

8.1 The bidder is advised to visit and examine the Site of Works and its surroundings and obtain for himself on his own responsibility all information that may be necessary for preparing the bid and entering into a contract for construction of the Works. The costs of visiting the Site shall be at the bidder's own expense.

8.2 The bidder and any of his personnel or agents will be granted permission by the Employer to enter upon his premises and lands for the purpose of such inspection, but only upon the express condition that the bidder, his personnel and agents, will release and indemnify the Employer and his personnel and agents from and against all liability in respect thereof and will be responsible for death or personal injury, loss of or damage to property and any other loss, damage, costs and expenses incurred as a result of the inspection.

8.3 The Employer may conduct a Site visit concurrently with the Pre-Bid Meeting referred to in Clause 19.

B. Bidding Documents

9. Content of Bidding Documents

9.1 The bidding documents are those stated below, and should be read in conjunction with any Addenda issued in accordance with Clause 11:

Invitation for Bids
Section

1 Instructions to Bidders
2 General Conditions of Contract
3 Conditions of Particular Application
4 Technical Specifications
5 Forms of Bid, Appendix to Bid, and Bid Security
6 Bill of Quantities
7 Form of Agreement
8 Forms of Performance Security, and of Bank Guarantee for Advance Payment
9 Supplementary Schedules Nos. I to XI
10 Supplementary Information
11 Drawings

9.2 Four copies of Sections 5, 6, 7 and 9 are supplied. Three copies should be completed and returned with the bid.

9.3 The bidder is expected to examine carefully the contents of all the above documents. Failure to comply with the requirements of bid submission will be at the bidder's own risk. Pursuant to Clause 28, bids which are not substantially responsive to the requirements of the bidding documents will be rejected.

10. Clarification of Bidding Documents

10.1 A prospective bidder requiring any clarification of the bidding documents may notify the Employer in writing or by cable (hereinafter, the term "cable" is deemed to include telex and facsimile) at the Employer's address indicated in the Invitation for Bids, with a copy to the Employer's consulting engineers. The Employer will respond to any request for clarification which he receives earlier than thirty days prior to the deadline for submission of bids. Copies of the Employer's response will be forwarded to all purchasers of the bidding documents, including

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a description of the enquiry but without identifying its source.

The address of the Employer's consulting engineers is:

‹**particulars of consulting engineers**›

11. **Amendment of Bidding Documents**

11.1 At any time prior to the deadline for submission of bids, the Employer may, for any reason, whether at his own initiative or in response to a clarification requested by a prospective bidder, modify the bidding documents by issuing addenda.

11.2 Any addendum thus issued shall be part of the bidding documents pursuant to Sub-Clause 9.1, and shall be communicated in writing or by cable to all purchasers of the bidding documents. Prospective bidders shall acknowledge receipt of each addendum by cable to the Employer.

11.3 To afford prospective bidders reasonable time in which to take an addendum into account in preparing their bids, the Employer shall extend as necessary the deadline for submission of bids, in accordance with Clause 22.

C. **Preparation of Bids**

12. **Language of Bid**

12.1 The bid, and all correspondence and documents related to the bid exchanged by the bidder and the Employer shall be written in the English language. Supporting documents and printed literature furnished by the bidder may be in another language provided they are accompanied by an accurate translation of the relevant passages in the above stated language, in which case, for purposes of interpretation of the bid, the English translation shall prevail.

13. **Documents Comprising the Bid**

13.1 The bid submitted by the bidder shall comprise the following: Bid Form and Appendix to Bid; Bid Security; priced Bill of Quantities; the information on eligibility and qualification; alternative offers where invited; and any other

materials required to be completed and submitted by bidders in accordance with these Instructions to Bidders. The documents listed under Sections 5, 6, 7 and 9 of Sub-Clause 9.1 shall be filled in without exception, subject to extension thereof in the same format and to the provisions of Sub-Clause 17.2 regarding the alternative forms of bid security.

13.2 Bidders bidding for this Contract together with other contracts to form a package, will so indicate in the Form of Bid, together with any discounts offered for the award of more than one contract and a statement as to how such discounts would be applied.

14. **Bid Prices**

14.1 Unless stated otherwise in the bidding documents, the Contract shall be for the whole Works as described in Sub-Clause 1.1, based on the schedule of unit rates and prices submitted by the bidder.

14.2 The bidder shall fill in rates and prices for all items of the Works described in the Bill of Quantities. Items against which no rate or price is entered by the bidder will not be paid for by the Employer when executed and shall be deemed covered by the other rates and prices in the Bill of Quantities.

14.3 All duties, taxes and other levies payable by the Contractor under the Contract, or for any other cause, as of the date 28 days prior to the deadline for submission of bids, shall be included in the rates and prices and the total bid price submitted by the bidder, and the evaluation and comparison of bids by the Employer shall be made accordingly.

14.4 The rates and prices quoted by the bidder are subject to adjustment during the performance of the Contract in accordance with the provisions of Clause 70 of the Conditions of Contract. The bidder shall furnish the indices for the price adjustment formulae in the Appendix to Bid, and shall submit with his bid such other supporting information as required under Clause 70 of the Conditions of Contract.

15. **Currencies of Bid and Payment**

15.1 The unit rates and the prices shall be quoted by the bidder entirely in Bangladesh Taka. The amounts shall be rounded to the nearest whole Taka. A bidder expecting to incur expenditures

in other currencies for inputs to the Works supplied from outside the Employer's country (referred to as "the foreign currency requirements") shall indicate in the Appendix to Bid the proportion of the Bid Price (excluding Provisional Sums and Provisional Items) needed by him for the payment of such foreign currency requirements, either (i) entirely in the currency of the bidder's home country or, at the bidder's option, (ii) entirely in U.S dollars or (iii) entirely in the European Currency Unit (ECU) always provided that a bidder expecting to incur expenditures in a currency or currencies other than those stated in (i) and (ii) above for a portion of the foreign currency requirements, and wishing to be paid accordingly, shall indicate the respective portion in his bid.

15.2 The rates of exchange to be used by the bidder for currency conversion shall be the selling rates for similar transactions published by the Bangladesh Bank prevailing on the date 28 days prior to the deadline for submission of bids.

For the purpose of payments, the exchange rates used in bid preparation shall apply for the duration of the Contract so that no currency exchange risk is borne by the bidder.

15.3 Bidders shall indicate their expected foreign currency requirements in the Appendix to Bid and in Schedule No. II, including but not limited to the specific requirements for

(a) expatriate staff and labour employed directly on the Works;

(b) social, insurance, medical and other charges relating to such expatriate staff and labor, and foreign travel expenses;

(c) imported materials, both temporary and permanent, including fuels, oil and lubricants required for the Works;

(d) depreciation and usage of imported Plant and Contractor's Equipment, including spare parts, required for the Works;

(e) foreign insurance and freight charges for imported materials, Plant and

Contractor's Equipment, including spare parts; and

(f) overhead expenses, fees, profit, and financial charges arising outside Bangladesh in connection with the Works.

15.4 Bidders may be required by the Employer to clarify their foreign currency requirements, and to substantiate that the amounts included in the unit rates and prices and shown in the Appendix to Bid are reasonable and responsive to Sub-Clause 15.1.

15.5 During the progress of the Works, the foreign currency portions of the outstanding balance of the Contract Price may be adjusted by agreement between the Employer and the Contractor in order to reflect any changes in foreign currency requirements for the Contract, in accordance with Sub-Clause 72.2 of the Conditions of Contract. Any such adjustment shall be effected by comparing the percentages quoted in the bid with the amounts already used in the Works and the Contractor's future needs for imported items.

16. Bid Validity

16.1 Bids shall remain valid for a period of 180 days after the date of bid opening specified in Clause 25.

16.2 In exceptional circumstances, prior to expiry of the original bid validity period, the Employer may request that the bidders extend the period of validity for a specified additional period. The request and the response thereto shall be made in writing or by cable. A bidder may refuse the request without forfeiting his bid security. A bidder agreeing to the request will not be required or permitted to modify his bid, but will be required to extend the validity of his bid security for the period of the extension, and in compliance with Clause 17 in all respects.

17. Bid Security

17.1 The bidder shall furnish, as part of his bid, security in the amount of <.....> Bangladesh Taka or an equivalent amount in a freely convertible currency.

17.2 The bid security shall, at the bidder's option, be in the form of a certified cheque, bank

draft, standby letter of credit or guarantee from a bank located in the country of the Employer or a foreign bank which has been determined by the bidder to be acceptable to the Employer, or a bond issued by a surety located in the country of the Employer or abroad and determined by the bidder to be acceptable to the Employer. The format of the bank guarantee or bond shall be in accordance with one of the sample forms of bid security included in Section 5; other formats may be permitted, subject to the prior approval of the Employer. Letters of credit, bank guarantees and bonds issued as surety for the bid shall be valid of 28 days beyond the validity of the bid.

17.3 Any bid not accompanied by an acceptable bid security shall be rejected by the Employer as nonresponsive.

17.4 The bid securities of unsuccessful bidders will be returned as promptly as possible, but not later than 28 days after the expiration of the period of bid validity.

17.5 The bid security of the successful bidder will be returned when the bidder has signed the Agreement and furnished the required performance security.

17.6 The bid security may be forfeited

(a) if the bidder withdraws his bid during the period of bid validity;

(b) if the bidder does not accept the correction of his bid price, pursuant to Sub-Clause 29.2; or

(c) in the case of a successful bidder, if he fails within the specified time limit to

(i) sign the Agreement, or

(ii) furnish the required performance security.

18. Alternative Proposals by Bidders and Alternative Bills to be Priced

18.1 Bidders wishing to qualify their bids or otherwise deviate from the requirements of the bidding documents on matters of a financial/ administrative nature shall present such qualifications or deviations in the form of an alternative offer to the basic bidding requirements, provided always that, for the alternative to be considered, the bidder must supply a fully priced conforming bid. The attention of bidders is drawn to the provisions of Clause 28 regarding the rejection of bids which are not substantially responsive to the requirements of the bidding documents. Each alternative offer shall be accompanied by a detailed description and price breakdown indicating the bidder's estimate of the cost implications to the Employer in accordance with Clause 31 if the alternative offer were to be accepted by the Employer and incorporated in the Contract. Bids containing qualifications and deviations which are not so detailed and priced as alternative offers may be rejected. After evaluation in accordance with Clause 31 the Employer reserves the right to accept or reject any alternative offer submitted pursuant to this Sub-Clause.

18.2 Bidders wishing to offer technical alternatives to the requirements of the bidding documents must first price the Employer's design as described in the bidding documents and shall further provide all information necessary for a complete evaluation of the alternative by the Employer, including drawings, design calculations, technical specifications, breakdown of prices, and proposed construction methods. Technical alternatives which comply with the performance specifications for the Works shall be considered by the Employer on their own merits.

18.3 The Drawings and Specification provide for the Works to be constructed with revetment primary armouring below Low Water Level + 2.00 m to be formed using one of three different materials, namely:

Material A. Precast concrete cubic blocks with course aggregate of crushed brick.

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Material B. Precast concrete cubic blocks with course aggregate of crushed stone or gravel.

Material C. Rock

Bidders are to price all three options which are measured separately in the Bill of Quantities. The totals for each of Materials A, B and C are to be carried forward so that the Grand Summary sheets each reflect a total Bid for the Works incorporating Material A or Material B or Material C. Forms of Tender shall be completed for all three options. Only one Bid Security need be submitted.

19. **Pre-Bid Meeting**

19.1 The bidder or his official representative is invited to attend a pre-bid meeting which will take place at the time and place stated in the letter of Invitation for Bids.

19.2 The purpose of the meeting will be to clarify issues and to answer questions on any matter that may be raised at that stage.

19.3 The bidder is requested to submit any questions in writing or by cable, to reach the Employer, with a copy to the Employer's consulting engineers not later than one week before the meeting.

19.4 Minutes of the meeting, including the text of the questions raised and the responses given, will be transmitted without delay to all purchasers of the bidding documents. Any modifications of the bidding documents listed in Sub-Clause 9.1 which may become necessary as a result of the pre-bid meeting shall be made by the Employer exclusively through the issue of an Addendum pursuant to Clause 11 and not through the minutes of the pre-bid meeting.

19.5 Nonattendance at the pre-bid meeting will not be a cause for disqualification of a bidder.

20. **Format and Signing of Bid**

20.1 The bidder shall prepare one original and two copies of the documents comprising the bid as described in Clause 13 of these Instructions to Bidders, bound with the volume containing the Form of Bid, and clearly marked "ORIGINAL" and "COPY" as appropriate. In the event of

discrepancy between them, the original shall prevail.

20.2 The original and all copies of the bid shall be typed or written in indelible ink (in the case of copies, photostats are also acceptable) and shall be signed by a person or persons duly authorised to sign on behalf of the bidder, pursuant to Sub-Clauses 5.1 (a) or 5.2 (c), as the case may be. All pages of the bid where entries or amendments have been made shall be initialled by the person or persons signing the bid.

20.3 The bid shall contain no alterations, omissions or additions, except those to comply with instruction issued by the Employer, or as necessary to correct errors made by the bidder, in which case such corrections shall be initialled by the person or person signing the bid.

D. Submission of Bids

21. Sealing and Marking of Bids

21.1 The bidder shall seal the original and each copy of the bid in an inner and an outer envelope, duly marking the envelopes as "ORIGINAL" and "COPY".

21.2 The inner and outer envelopes shall

(a) be addressed to the Employer at the following address:

The Chief Engineer, Planning
Bangladesh Water Development Board
WAPDA Building
Motijheel Commercial Area
Dhaka,
Bangladesh

(b) bear the following identification:

- Bid for Project, Brahmaputra Right Bank Phase 1 Works <**contract no. & title**>
- Bid Reference Number:

- DO NOT OPEN BEFORE (the time and date letter of Invitation for Bids).

21.3 In addition to the identification required in Sub-Clause 21.2, the inner envelope shall indicate the name and address of the bidder to enable the bid to be returned unopened in case it is declared "late" pursuant to Clause 23.

21.4 If the outer envelope is not sealed and marked as above, the Employer will assume no responsibility for the misplacement or premature opening of the bid.

22. **Deadline for Submission of Bids**

22.1 Bids must be received by the Employer at the address specified above no later than the time and date stated in the letter of Invitation for Bids.

22.2 The Employer may, at his discretion, extend the deadline for submission of bids by issuing an addendum in accordance with Clause 11, in which case all rights and obligations of the Employer and the bidders previously subject to the original deadline will thereafter by subject to the deadline as extended.

23. **Late Bids**

23.1 Any bid received by the Employer after the deadline for submission of bids prescribed in Clause 22 will be returned unopened to the bidder.

24. **Modification and Withdrawal of Bids**

24.1 The bidder may modify or withdraw his bid after bid submission, provided that written notice of the modification or withdrawal is received by the Employer prior to the deadline for submission of bids.

24.2 The bidder's modification or withdrawal notice shall be prepared, sealed, marked and delivered in accordance with the provisions of Clause 21, with the outer and inner envelope additionally marked "MODIFICATION" or "WITHDRAWAL", as appropriate.

24.3 No bid may be modified by the bidder after the deadline for submission of bids.

24.4 Withdrawal of a bid during in interval between the deadline for submission of bids and the expiration of the period of bid validity

specified in the Form of Bid may result in the forfeiture of the bid security pursuant to Clause 17.

E. **Bid Opening and Evaluation**

25. Bid Opening

25.1 The Employer will open the bids, including modifications made pursuant to Clause 24, in the presence of bidders' representatives who choose to attend, at the time, date and place stated in the letter of Invitation for Bids. The bidders' representatives who are present shall sign are a register evidencing their attendance.

25.2 Envelope marked "WITHDRAWAL" shall be opened and read out first. Bids for which an acceptable notice of withdrawal has been submitted pursuant to Clause 24 shall not be opened.

25.3 The bidders' names, the Bid Prices, the total amount of each bid and of any alternative bid (if alternatives have been requested or permitted), any discounts, bid modifications and withdrawals, the presence or absence of bid security, and such other details as the Employer may consider appropriate, will be announced by the Employer at the opening. Any bid price, discount or alternative bid price which is not read out and recorded at bid opening will not be taken into account in bid evaluation.

25.4 The Employer shall prepare minutes of the bid opening, including the information disclosed to those present in accordance with Sub-Clause 25.3.

26. Process to Be Confidential

26.1 Information relating to the examination, clarification, evaluation and comparison of bids and recommendations for the award of a contract shall not be disclosed to bidders or any other persons not officially concerned with such process until the award to the successful bidder has been announced. Any effort by a bidder to influence the Employer's processing of bids or award decisions may result in the rejection of the bidder's bid.

26.2 All recipients of the Tender Documents (whether they submit a bid or not) shall treat the

documents as private and confidential. Bidders shall not release details of the documents other than on an "In confidence" basis to those who have a legitimate need to know or whom they need to consult for the purpose of preparing a bid.

In the event of a bidder declining to tender, the full set of documents shall be returned immediately to the address stated in the Letter of Invitation.

27. **Clarification of Bids**

27.1 To assist in the examination, evaluation and comparison of bids, the Employer may, at his discretion, ask any bidder for clarification of his bid, including breakdowns of unit rates.

The request for clarification and the response shall be in writing or by cable, but no change in the price or substance of the bid shall be sought, offered or permitted except as required to confirm the correction of arithmetic errors discovered by the Employer in the evaluation of the bids in accordance with Clause 29.

28. **Examination of Bids and Determination of Responsiveness**

28.1 Prior to the detailed evaluation of bids, the Employer will determine whether each bid (i) meets the eligibility criteria of IDA (ii) has been property signed; (iii) is accompanied by the required securities; and (iv) is substantially responsive to the requirements of the bidding documents.

28.2 A substantially responsive bid is one which conforms to all the terms, conditions and specifications of the bidding documents, without material deviation or reservation. A material deviation or reservation is one (i) which affects in any substantial way the scope, quality or performance of the Works; (ii) which limits in any substantial way, inconsistent with the bidding documents, the Employer's rights or the bidder's obligations under the Contract; or (iii) whose rectification would affect unfairly the competitive position of other bidders presenting substantially responsive bids.

28.3 If a bid is not substantially responsive, it will be rejected by the Employer, and may not subsequently be made responsive by correction

or withdrawal of the nonconforming deviation or reservation.

29.1 Correction of Errors

29.1 Bids determined to be substantially responsive will be checked by the Employer for any arithmetic errors. Errors will be corrected by the Employer as follows:

(a) where there is a discrepancy between the amounts in figures and in words, the amount in words will govern; and

(b) where there is a discrepancy between the unit rate and the line item total resulting from multiplying the unit rate by the quantity, the unit rate as quoted will govern, unless in the opinion of the Employer there is an obviously gross misplacement of the decimal point in the unit rate, in which case the line item total as quoted will govern and the unit rate will be corrected.

29.2 The amount stated in the Form of Bid will be adjusted by the Employer in accordance with the above procedure for the correction of errors and, with the concurrence of the bidder, shall be considered as binding upon the bidder. If the bidder does not accept the corrected amount of bid, his bid will be rejected, and the bid security may be forfeited in accordance with Sub-Clause 17.6(b).

30. Conversion to Single Currency

30.1 The bid price shall be broken down into the respective amounts payable in various currencies by using the exchange rates specified in Clause 15.2. In the second step, the Employer will convert the amounts in various currencies in which the Bid Price is payable (excluding Provision Sums but including Daywork where priced competitively) to the currency of the Employer's country at the selling rates established by the Bangladesh Bank on the date specified for the opening of bids.

31. Evaluation and Comparison of Bids

31.1 The Employer will evaluate and compare only the bids determined to be substantially responsive in accordance with Clause 28.

31.2 In evaluating the bids, the Employer will determine for each bid the Evaluated Bid Price by adjusting the Bid Price as follows:

(a) making any correction for errors pursuant to Clause 29;

(b) excluding Provisional Sums and the provision, for contingencies in the Summary Bill of Quantities, but including Provisional Items and Daywork;

(c) making an appropriate adjustment for any other acceptable variations, deviations or alternative offers submitted in accordance with Clause 18;

(d) converting the amount resulting from applying (a) to (c) above to a single currency in accordance with Clause 30; and

(e) applying any discounts offered by the bidder for the award of more than one contract.

31.3. The Employer reserves the right to accept or reject any variation, deviation or alternative offer. Variations, deviations, alternative offers and other factors which are in excess of the requirements of the bidding documents or otherwise result in the accrual of unsolicited benefits to the Employer shall not be taken into account in bid evaluation.

31.4 The estimated effect of the price adjustment provision of the Conditions of Contract, applied over the period of execution of the Contract, shall not be taken into account in bid evaluation.

31.5 If the bid of the successful bidder is seriously unbalanced in relation to the Engineer's estimate of the cost of work to be performed under the Contract, the Employer may require the bidder to produce detailed price analyses for any or all items of the Bill of Quantities, to demonstrate the internal consistency of those prices with the construction methods and programme proposed. After evaluation of the price analyses, the Employer may require that the amount of the performance security set forth in Clause 37 be increased at the expense of the successful bidder to a level sufficient to protect the Employer against financial loss in the event of

default of the successful bidder under the Contract.

31.6 Certain provisional items in the Bill of Quantities are to be priced as "rate only" items and will not be extended and carried to the Bid Price. They will, however, be extended by the Employer and the amounts so obtained will be added to the Bid Price for the purposes of bid evaluation.

31.7 Bidders' attention is drawn to the importance of the technical submissions required in the Supplementary Schedules. These submissions will be evaluated by the Employer in accordance with the criteria set out below. Bids wherein the technical submission does not meet the required standard will be rejected.

Evaluation Criteria for Tender Technical Submissions

	Supplementary Schedule No.	Maximum	Minimum
Method Statement	VIII	30	20
Equipment List	IV	35	25
Programme	VII	15	10
Staff Organisation	X	10	5
Key Personnel	V	10	5
	Total:	100	

Submissions scoring less than the individual minima for any individual element, or less than 75 overall, will be rejected.

Points Allocation System

Method Statement. Maximum points will be awarded for a submission which demonstrates a full understanding of the technical and other difficulties which have to be overcome in the construction of the Works, and proposes practical means of overcoming them.

Equipment List. Maximum points will be awarded for a list which has a satisfactory spare capacity over the minimum theoretical requirement, and which includes equipment suitable for the work to be undertaken.

Programme. Maximum points will be awarded for a programme which demonstrates a clear understanding of the physical restraints imposed on the Contractor e.g. weather or access, and external restraints e.g. sectional completions. Correlation of the outputs of the proposed equipment and the method statement with the programme are also important.

Staff Organisation. Maximum points will be awarded for a proposed organisation which demonstrates the intention to employ staff of the appropriate experience in the key areas, and a sensible organisation for the control of the contract. Proposals for logistical support, e.g. an office in the principal city or at the port or a formal arrangement with a local company, will also be taken into account.

Key Personnel. Maximum points will be awarded if the nominees for the key positions in the organisation have appropriate experience - technical or managerial. Experience in the country or in the area will also be expected for some positions.

32. Preference for Domestic Bidders

Not applicable

F. Award of Contract

33. Award

33.1 Subject to Clause 34, the Employer will award the Contract to the bidder whose bid has been determined to be substantially responsive to the bidding documents and who has offered the Lowest Evaluated Bid Price for this Contract, when evaluated in conjunction with the other contracts to be awarded concurrently for this project and taking into account any discounts offered by bidders for the award of more than one contract provided that such bidder has been determined to be (i) eligible in accordance with the provisions of Sub-Clause 3.1, and (ii) qualified in accordance with the provisions of Clause 5.

34. Employer's Right to Accept any Bid and to Reject any or all Bids

34.1 Notwithstanding Clause 33, the Employer reserves the right to accept or reject any bid, and to annul the bidding process and reject all bids, at any time prior to award of Contract, without thereby incurring any liability to the affected bidder or bidders or any obligation to inform the affected bidder or bidders of the grounds for the Employer's action.

35. Notification of Award

35.1 Prior to expiration of the period of bid validity prescribed by the Employer, the Employer will notify the successful bidder by cable confirmed by registered letter that his bid has been accepted. This letter (hereinafter and in the Conditions of Contract called the "Letter of Acceptance") shall name the sum which the Employer will pay the Contractor in consideration of the execution, completion and maintenance of the Works by the Contractor as prescribed by the Contract (hereinafter and in the Conditions of Contract called "the Contract Price").

35.2 The notification of award will constitute the formation of the Contract.

35.3 Upon the furnishing by the successful bidder of a performance security the Employer will promptly notify the other bidders that their bids have been unsuccessful.

36. Signing of Agreement

36.1 At the same time that notifies the successful bidder that his bid has been accepted, the Employer will send the bidder the Form of Agreement provided in the bidding documents, incorporating all agreements between the parties.

36.2 Within 28 days of receipt of the Form of Agreement, the successful bidder shall sign the Form and return it to the Employer.

37. Performance Security

37.1 Within 28 days of receipt of the notification of award from the Employer, the successful bidder shall furnish to the Employer a performance security in the form of a bank guarantee in an amount of ten percent of the Contract Price or (at the bidder's option) a performance bond in an amount of thirty percent of the Contract Price in accordance with the Conditions of Contract. The forms of

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performance security provided in Section 9 of the bidding documents may be used or some other forms acceptable to the Employer.

37.2 If the performance security is to be provided by the successful bidder in the form of a bank guarantee, it shall be issued either (a) at the bidder's option, by a bank located in the country of the Employer or a foreign bank through a correspondent bank located in the country of the Employer, or (b) with the agreement of the Employer directly by a foreign bank acceptable to the Employer.

37.3 If the performance security is to be provided by the successful bidder in the form of a bond, it shall be issued by a bonding/insurance company which has been determined by the successful bidder to be acceptable to the Employer.

37.4 Failure of the successful bidder to comply with the requirements of Clauses 36 or 37 shall constitute sufficient grounds for the annulment of the award and forfeiture of the bid security.

BRAHMAPUTRA RIGHT BANK PHASE 1 WORKS

SECTION 2: CONDITIONS OF CONTRACT
PART I - GENERAL CONDITIONS

CONDITIONS OF CONTRACT

PART I - GENERAL CONDITIONS

The General Conditions of Contract are the Part 1 - General Conditions of Contract (International) for Works of Civil Engineering Construction prepared by the Federation Internationale des Ingenieurs-Conseils (F.I.D.I.C.) Fourth Edition dated 1987 (reprinted 1988 with editorial amendments) as modified or added to by the Conditions of Particular Application herein, which shall be read and construed with the General Conditions as if they were incorporated therewith. The General Conditions of Contract are not reproduced in this document.

BRAHMAPUTRA RIGHT BANK PHASE 1 WORKS

SECTION 3: CONDITIONS OF CONTRACT
PART II - CONDITIONS OF PARTICULAR APPLICATION

CONDITIONS OF CONTRACT

PART II: CONDITIONS OF PARTICULAR APPLICATION

Modifications

The following clauses of Part I of the Conditions of Contract are amended as noted and replaced as appropriate by the clauses similarly numbered in Part II of the Conditions of Contract.

Clause 1	-	Employer and Engineer defined. (f)(v) amended. (h) added
2	-	Sub-Clause 2.1. Engineer's actions requiring Employer's specific approval defined
4	-	Sub-Clauses 4.3 and 4.4 added
5	-	Language and law defined. Amendment to Sub-Clause 5.2
8	-	Sub-Clause 8.1 amended
10	-	Sub-Clause 10.1 amended. Sub-Clause 10.3 deleted
14	-	Sub-Clauses 14.1 and 14.3 amended
15	-	Sub-Clause 15.2 added.
16	-	Sub-Clause 16.3 and 16.4 added
18	-	Sub-Clause 18.1. Final sentence added
20	-	Sub-Clause 20.4 amended
21	-	Sub-Clauses 21.1, 21.2 and 21.4 amended
25	-	Sub-Clauses 25.1 and 25.5 amended
34	-	Sub-Clauses 34.2 to 34.21 added
35	-	Sub-Clauses 35.2 and 35.3 added
40	-	Sub-Clause 40.4 added
41	-	Sub-Clause 41.2 added
42	-	Sub-Clause 42.4 added
45	-	Sub-Clause 45.1 amended
46	-	Sub-Clause 46.2 added
49	-	New Sub-Clause 49.5 added for dredging work
50	-	New Sub-Clause 50.2 added for dredging work
52	-	Sub-Clauses 52.1 to 52.3 amended
54	-	Sub-Clauses 54.2 and 54.5 deleted
60	-	Rewritten
63	-	Sub-Clauses 63.1 to 63.4 amended
65	-	Sub-Clauses 65.2 amended
67	-	Rewritten
68	-	Sub-Clause 68.2. Addresses of Employer and Engineer defined
69	-	Sub-Clauses 69.1, 69.4 and 69.5 amended
70	-	Rewritten
72	-	Sub-Clause 72.2 amended
73 to 78		Clauses added

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Clause 1

Definitions

Sub-Clause 1.1

(a)(i) The Employer is the Bangladesh Water Development Board. The Employer's Representative is the Chief Engineer, Northern Zone, BWDB, Rajshahi.

(a)(iv) The Engineer is (to be appointed).

Sub-para. (a)(iv) is also amended by the addition of the following words after the word "Conditions":

"or any other competent person appointed by the Employer and notified to the Contractor, to act in replacement of the Engineer".

Sub-para. (b)(v) of Sub-Clause 1.1 is amended by the addition of the following words at the end:

"The word 'Tender' is synonymous with 'Bid' and the words 'Tender Documents' with 'Bidding Documents'."

(f)(v) Add a final sentence as follows:

"Unless explicitly stated otherwise, references to Contractor's Equipment shall be understood to include waterborne equipment".

(h) Add a further definition as follows:

"Approval by the Engineer" means the process of examination, inspection or checking of designs, drawings, materials, programme, methods of working, sub-letting or other matters required by the Contract to be proposed by the Contractor which results in the acceptance, agreement or consent of the Engineer as being in accordance with the Contract. Such approval by the Engineer shall not relieve the Contractor of any of his obligations and responsibilities under the Contract.

Clause 2

Engineer's Duties and Authority

Sub-Clause 2.1

The Engineer shall obtain the specific approval of the Employer in writing before taking any of the following actions specified in Part I of the Conditions of Contract:

(a) approving sub-letting of any part of the Works under Clause 4;

(b) certifying additional cost determined under Clause 12;

(c) determining an extension of time under Clause 44;

(d) issuing a variation under Clause 51, except:

(i) in an emergency situation, as reasonably determined by the Engineer; or

(ii) if such variation would increase the Contract Price by less than two and a half percent (2½%)

(e) fixing rates or prices under Clause 52.

Clause 4

Add the following Sub-Clauses 4.3 and 4.4:

Subcontracting

Sub-Clause 4.3

Where consent of the Engineer is given for the subcontracting of any part of the Works, the Contractor shall obtain prior written approval from the Engineer of the terms of any such proposed subcontract and shall ensure that all appropriate provisions of the Contract are included therein particularly in respect of eligibility of equipment supplier and equipment, vesting of title, insurance, time cost, quality and safety control, indemnities to Contractor and Employer, payments, the assignment without consent of the subcontractor to the Employer in the event of termination hereunder and the circumstances and mechanisms under which the Contractor and/or the subcontractor may terminate the subcontract.

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Any further subletting of the subcontract work including procurement of materials, equipment and all other matters shall reflect these provisions and shall in any event encompass all such interests of the Employer.

Assignment of Subcontractor's Obligations

Sub-Clause 4.4

For the purposes of Sub-Clause 4.1, where the consent of the Engineer is sought for the subletting of any part of the Works, the Contractor shall submit to the Engineer within a reasonable time for the Engineer to give his consent a written application including particulars of the part of the Works to be sublet, the particulars of the proposed subcontractor as relevant for that part of the Works to be sublet and generally in accordance with prequalification criteria previously agreed in writing by the Engineer. The Engineer's consent shall be given where the Contractor has demonstrated that his proposals to subcontract to the proposed subcontractor are reasonable.

Clause 5

Language and Law

Sub-Clause 5.1

(a) The language is English.

(b) The law is that in force in the People's Republic of Bangladesh.

Priority of Contract Documents

Sub-Clause 5.2

Delete the documents listed 1 - 6 and substitute:

(1) the Contract Agreement
(2) the Letter of Acceptance;
(3) the Tender;
(4) the Conditions of Contract Part II;
(5) the Conditions of Contract Part I;
(6) the Specification;
(7) the Drawings;
(8) the priced Bill of Quantities; and
(9) Supplementary Schedules Nos. I, II and XI

Clause 8

Contractors's General Responsibilities

Sub-Clause 8.1

Add the following sentence at the end of Sub-Clause 8.1

"The Contractor shall promptly inform the Employer and the Engineer of any error, omission, fault or any other defect in the design of or specifications for the Works which he discovers when reviewing the Contract Documents or in the process of execution of the Works".

Clause 10

Performance Security

Sub-Clause 10.1

Replace the text of Sub-Clause 10.1 with the following:

"The Contractor shall provide security for his proper performance of the Contract to the Employer within 28 days after the receipt of the Letter of Acceptance.

The performance security shall be in the form of a bank guarantee, standby letter of credit, or a bond, at the Contractor's option. The amount of the bank guarantee or the standby letter of credit shall be 10 percent of the Contract Price, or the amount of bond provided by an insurance or bonding company shall be 30 percent of the Contract Price. If the performance security is in the form of a bank guarantee, it shall be issued either (a) by a bank located in the country of the Employer or a foreign bank through a correspondent bank located in the country of the Employer, or (b) directly by a foreign bank acceptable to the Employer. The performance security shall be denominated in the types and proportions of currencies in which the Contract Price is payable. When providing such security to the Employer, the Contractor shall notify the Engineer of so doing.

"Without limitation to the provisions of the preceding paragraph, whenever the Engineer determines an addition to the Contract Price as a result of a change in cost and/or legislation or as a result of a variation amounting to more than 25 percent of the portion of the Contract Price payable in a specific currency, the Contractor, at the Engineer's written request, shall promptly increase the value of the performance security in that currency by an equal percentage."

Claims Under Performance Security

Sub-Clause 10.3

Delete Sub-Clause 10.3

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Clause 14

Sub-Clause 14.1

Programme to be Submitted

Add the following to Sub-Clause 14.1.

"The time within which the programme shall be submitted shall be 56 days."

Cash Flow to be Submitted

Sub-Clause 14.3

Add the following to sub-clause 14.3.

"The time within which the detailed cash flow estimate shall be submitted shall be 70 days".

Clause 15

Language Ability of Contractors's Representative

Sub-clause 15.2

Add the following Sub-Clause 15.2

"The Contractor's authorised representative shall be fluent in spoken and written English."

Clause 16

Add the following Sub-Clauses 16.3 and 16.4:

Language Ability of Superintending Staff

Sub-Clause 16.3

"A reasonable proportion of the Contractor's superintending staff shall have a working knowledge of English or the Contractor shall have available on site at all times a sufficient number of competent interpreters to ensure the proper transmission of instructions and information."

Employment of Local Personnel

Sub-Clause 16.4

The Contractor is encouraged to the extent practicable and reasonable, to employ staff and labour from sources within Bangladesh.

Clause 18

Borehole and Exploratory Excavation

Sub-Clause 18.1

Add a final sentence:

"Exploratory excavation shall be deemed to include dredging".

Clause 20

Employer's Risks

Sub-Clause 20.4

Sub-Clause 20.4 is amended to read as follows:

The Employer's risks are:

(a) insofar as they directly affect the execution of the Works in the country where the Permanent Works are to be executed:

(i) war and hostilities (whether war be declared or not), invasion, act of foreign enemies;

(ii) rebellion, revolution, insurrection, or military or usurped power, or civil war;

(iii) ionizing radiations, or contamination by radioactivity from any nuclear fuel, or from any nuclear waste from the combustion of nuclear fuel, radioactive toxic explosive or other hazardous properties of any explosive nuclear assembly or nuclear component thereof;

(iv) pressure waves caused by aircraft or other aerial devices travelling at sonic or supersonic speeds;

(v) riot, commotion or disorder, unless solely restricted to the employees of the Contractor or of his Subcontractors and arising from the conduct of the Works;

(b) loss or damage due to the use or occupation by the Employer of any Section or part of the Permanent Works, except as may be provided for in the Contract;

(c) loss or damage to the extent that it is due to the design of the Works, other than any part of

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the design provided by the Contractor or for which the Contractor is responsible; and

(d) any operation of the forces of nature (insofar as it occurs on the Site) which an experienced contractor:

(i) could not have reasonably foreseen, or

(ii) could reasonably have foreseen, but against which he could not reasonably have taken at least one of the following measures:

(A) prevent loss or damage to physical property from occurring by taking appropriate measures, or

(B) insure against

Clause 21

Insurance of Works and Contractor's Equipment

Sub-Clause 21.1

Add the following words at the end of sub-paras. (a) and (b) of Sub-Clause 21.1:

", it being understood that such insurance shall provide for compensation to be payable in the types and proportions of currencies required to rectify the loss or damage incurred."

Add at the end of Sub-Clause 21.1:

"It shall be the responsibility of the Contractor to notify the insurer of any change in nature and extent of the Works and to ensure the adequacy of the insurance cover at all times in accordance with the provision of this Clauses."

Scope of Cover

Sub-Clause 21.2

Para (a) of Sub-Clause 21.2 is amended by deletion of the words" ... from the start of work at the Site ..." and by the substitution therefor of the words" .. from the first working day after the Commencement Date .."

Exclusions

Sub-Clause 21.4

Sub-Clause 21.4 is amended to read as follows:

"There shall be no obligation for the insurance in

Sub-Clause 21.1 to include loss or damage caused by the risks listed under Sub-Clause 20.4 paras. (a)(i) to (iv)."

Clause 25

Evidence and Terms of Insurance

Sub-Clause 25.1

Sub-Clause 25.1 is amended by inserting the words " .. as soon as practicable after the respective insurance have been taken out but in any case ..." before the words " ... prior to the start of work at the Site ...".

Source of Insurance

Sub-Clause 25.5

Add the following the Sub-Clause 25.5

"The Contractor shall be entitled to place all insurance relating to the Contractor (including, but not limited to, the insurance referred to in Clauses 21, 23 and 24) with insurers from any eligible source country as defined in the IBRD Guidelines for Procurement."

Clause 34

Add the following Sub-Clauses 34.2 to 34.21 inclusive:

Conditions of Employment

Sub-Clause 34.2

The Contractor shall, in respect of all persons employed by him for the execution of the Contract, comply with the requirements of the labour laws of the People's Republic of Bangladesh regarding the employment of labour. The attention of the Contractor is particularly drawn to the requirements concerning hours and conditions of labour, holidays, night work, rates of pay, sanitary and safety conditions, medical services, health and social insurance, and accident insurance.

Wages and Hours

Sub-Clause 34.3

The Contractor shall pay local labour employed by him under this Contract not less than the minimum Government rate of wages, and observe the hours and conditions of labour so established; the Contractor shall pay rates of wages and observe hours and conditions of labour which are not less favourable than the general level of wages, hours and conditions observed by other employers whose general

circumstances in trade or industry in which the Contractor is engaged are similar.

Payment of Wages

Sub-Clause 34.4

The Contractor shall ensure that all personnel employed by him or by his sub-contractors on the Works are paid their wages in full at least every month and that such persons are paid at the Site if this is practicable.

Employment of Persons in the Service of Others

Sub-Clause 34.5

The Contractor shall not recruit or attempt to recruit his staff and labour from amongst persons in the service of the Employer or the Engineer.

Employment of Foreign Personnel

Sub-Clause 34.6

The Contractor will be permitted to assign qualified foreign personnel for employment in Bangladesh for the purpose of carrying out the Contract. The Employer will assist the Contractor in obtaining work permits and other documents required to facilitate entry, residence and departure of foreign personnel employed by the Contractor but the responsibility for obtaining such permits and documents shall rest with the Contractor.

Repatriation of Labour

Sub-Clause 34.7

The Contractor shall be responsible for the return to the place where they were recruited or to their domicile of all such persons as he recruited and employed for the purposes of or in connection with the Contract and shall maintain such persons as are to be so returned in a suitable manner until they shall have left the Site or, in the case of persons who are not nationals of and have been recruited outside Bangladesh, shall have left Bangladesh.

Housing for Labour

Sub-Clause 34.8

Save insofar as the Contract otherwise provides, the Contractor shall provide and maintain such accommodation and amenities as he may consider necessary for all his staff and labour, employed for the purposes of or in connection with the Contract, including all fencing, water supply (both for drinking and other purpose), electricity supply, sanitation, cook houses, fire prevention and firefighting equipment, air conditioning, cookers, refrigerators,

furniture and other requirements in connection with such accommodation or amenities. On completion of the Contract, unless otherwise agreed with the Employer, the temporary camps/housing provided by the Contractor shall be removed and the site reinstated to its original condition, all to the approval of the Engineer.

Accident Prevention

Sub-Clause 34.9

The Contractor shall take all necessary precautions for the safety of his employees and other persons on the Site and shall have on his staff at Site an officer dealing only with matters concerning safety and protection against accidents. This officer shall be qualified for this work and shall have the authority to issue instructions and shall take protective measures to prevent accidents. The Contractor shall comply with all statutory requirements and with such directions as the Engineer may from time to time consider necessary or desirable.

The Contractor shall provide and maintain all necessary protective clothing and equipment including safety nets and harnesses as required, and when work is in progress on, over or near water, life preservers and rescue boats.

First Aid

Sub-Clause 34.10

The Contractor shall provide and maintain on the Site adequate and easily accessible first aid facilities for treatment in case of accidents during the execution of the Works and such outfits as may be required by any relevant Laws, Bye-Laws, Ordinances and regulations for the time being in force. The places where these items are kept shall be prominently marked. A sufficient number of the Contractor's employees shall be fully qualified in first aid so that such a first aid man is promptly available in case of accident at any time and at any place and the persons so designated shall be made known to all employees by the posting of their names and designations in a prominent position on the Site. Any order from the Engineer as to the extensions of or alterations to such first aid facilities or services shall be carried out promptly.

Health and Safety

Sub-Clause 34.11

Due precautions shall be taken by the Contractor, and at his own cost, to ensure the safety of his staff and

labour and, in collaboration with and to the requirements of the local health authorities, to ensure that medical staff, first aid equipment and stores, sick bay and suitable ambulance service are available at the camps, housing and on the Site at all times throughout the period of the Contract and that suitable arrangements are made for the prevention of epidemics and for all necessary welfare and hygiene requirements.

Measures Against Insect and Pest Nuisance

Sub-Clause 34.12

The Contractor shall at all times take the necessary precautions to protect all staff and labour employed on the Site from insect nuisance, rats, and other pests and reduce the dangers to health and the general nuisance caused by the same. The Contractor shall provide his staff and labour with suitable prophylactics for the prevention of malaria, and take steps to prevent the formation of stagnant pools of water. He shall comply with all the regulations of the local health authorities in these respects and shall in particular arrange to spray thoroughly with approved insecticide all buildings erected on the Site. Such treatment shall be carried out at least once a year or as instructed by the Engineer.

Epidemics

Sub-Clause 34.13

In the event of any outbreak of illness of an epidemic nature, the Contractor shall comply with and carry out such regulations, orders and requirements as may be made by the Government or the local medical or sanitary authorities, for the purpose of dealing with overcoming the same.

Burial of the Dead

Sub-Clause 34.14

The Contractor shall make any necessary arrangements for the transport, to any place as required for burial, of any of his expatriate employees or members of their families who may die in Bangladesh. The Contractor shall also be responsible, to the extent required by the local regulations, for making any arrangements with regard to burial of any of his local employees who die be while engaged upon the works.

Supply of Foodstuffs

Sub-Clause 34.15

The Contractor shall arrange for the provision of a sufficient supply of suitable food at reasonable prices for all his staff and labour, or his

Subcontractors, for the purposes of or in connection with the Contract.

Supply of Water

Sub-Clause 34.16

The Contractor shall, so far as is reasonably practicable having regard to local conditions, provide on the site an adequate supply of drinking and other water for the use of his staff and labour.

Alcoholic Liquor or Drugs

Sub-Clause 34.17

The Contractor shall not, otherwise than in accordance with the Statutes, Ordinances and Government Regulations or Orders for the time being in force, import, sell, give, barter, or otherwise dispose of any alcoholic liquor or drugs, or permit or suffer any such importation, sale, gift, barter or disposal by his Subcontractors, agents, staff or labour.

Arms and Ammunition

Sub-Clause 34.18

The Contractor shall not give, barter, or otherwise dispose of to any person or persons, any arms or ammunition of any kind or permit or suffer the same as aforesaid.

Festivals and Religious Customs

Sub-Clause 34.19

The Contractor shall in all dealings with his staff and labour have due regard to all recognized festivals, days of rest and religious and other customs.

Disorderly Conduct

Sub-Clause 34.20

The Contractor shall at all times take all reasonable precautions to prevent any unlawful, riotous or disorderly conduct by or amongst his staff and labour and for the preservation of peace and protection of persons property in the neighbourhood of the Works against the same.

Copy of Clause to be Displayed

Sub-Clause 34.21

The Contractor shall at all times during the Contract display a copy of this Clause for the information of his workpeople in any place occupied or used by him for the execution of the Contract.

Clause 35

Add the following Sub-Clauses 35.2 and 35.3

Records of Safety and Health

Sub-Clause 35.2

The Contractor shall maintain such records and make such reports concerning safety, health and welfare of persons and damage to property as the Engineer may from time to time prescribe.

Reporting of Accidents

Sub-Clause 35.3

The Contractor shall report to the Engineer details of any accident as soon as possible after its occurrence. In the case of any fatality or serious accident, the Contractor shall, in addition, notify the Engineer immediately by the quickest available means.

Clause 40

Charter Hire in Event of Suspension

Sub-Clause 40.4

Add new Sub-Clause 40.4:

In the event of suspension of work by the Engineer, the extra cost to be borne by the Employer shall in the case of Contractor's Equipment chartered by the Contractor include the bare boat charter hire of such Equipment in lieu of its depreciation.

Clause 41

Timing of Commencement

Add new Sub-Clause 41.2

Regardless of the date of the Letter of Acceptance, the notice to commence the Works shall be issued between the first day of June and the thirtieth day of September following the issue of the Letter of Acceptance.

Clause 42

Use of Site

Sub-Clause 42.4

Add new Sub-Clause 42.4.

The Contractor shall not use the Site for any purpose other than the execution of the Works.

Clause 45

Restriction on Working Hours

Sub-Clause 45.1

Add the following at the end of Clause 45.1

"Subject to any provision to the contrary contained in the Contract, the Contractor shall have the option to work continuously by day and by night and on locally recognised holidays or days of rest on dredging and/or reclamation work required under the Contract.

Clause 46

Provision for Accelerated Completion

Sub-Clause 46.2

Add new Sub-Clause 46.2 a follows:

If the Contractor is requested by the Employer or the Engineer to complete the Works or any Section within a revised time being less than the time or extended time for completion prescribed by Clauses 43 and 44 as appropriate and the Contractor agrees so to do then any special terms and conditions of payment shall be agreed between the Contractor and the Employer before any such action is taken.

Clause 49

No Remedying of Defects in Dredging Work after Completion

Sub-Clause 49.5

Add new Sub-Clause 49.5 as follows:

Notwithstanding Sub-Clause 49.2, the Contractor shall have no responsibility for the remedying of defects, shrinkages or other faults in respect of dredging work after the date stated in the Taking-Over Certificate.

Clause 50

No Responsibility for Cost of Searching of Dredging Work

Sub-Clause 50.2

Add new sub-clause 50.2 as follows:

Notwithstanding Sub-Clause 50.1, the Contractor shall have no responsibility to bear the cost of searching for any defect, shrinkage or other fault in respect of dredging work after the date stated in the Taking-Over Certificate.

Clause 52

Valuation of Variations

Sub-Clause 52.1

Add final sentences as follows:

"Where the Contract provides for the payment of the Contract Price in more than one currency, and varied work is valued at, or on the basis of, the rates and prices set out in the Contract, payment for such varied work shall be made in the proportions of various currencies specified in the Appendix to Tender for payment of the Contract Price. Where the Contract provides for payment of the Contract Price in more than one currency, and new rates or prices are agreed, fixed or determined as stated above, the amount or proportion payable in each of the applicable currencies shall be specified when the rates or prices are agreed, fixed or determined, it being understood that in specifying these amounts or proportions the Contractor and the Engineer (or, failing agreement, the Engineer) shall take into account the actual or expected currencies of cost (and the proportions thereof) of the inputs of the varied work without regard to the proportions of various currencies specified in the Appendix to Tender for payment of the Contract Price.

Power of Engineer to Fix Rates

Sub-Clause 52.2

Add a final sentence to the first paragraph, as follows:

"Where the Contract provides for the payment of the Contract Price in more than one currency, the amount or proportion payable in each of the applicable currencies shall be specified when the rates or prices are agreed, fixed or determined as stated above, it being understood that in specifying these amounts or proportions the Contractor and the Engineer (or, failing agreement, the Engineer) shall take into account the actual or expected currencies of cost (and the proportions thereof) of the inputs of the varied work without regard to the proportions of various currencies specified in the Appendix to Tender for payment of the Contract Price".

At the end of the first paragraph, add:

"Provided further that no change in the rate or price for any item contained in the Contract shall be considered unless such item accounts for an amount

more than 2 percent of the Contract Price, and the actual quantity of work executed under the item exceeds or falls short of the quantity set out in the Bill of Quantities by more than 25 percent."

Variations Exceeding 15 Percent

Sub-Clause 52.3

In (b), add the words "Provisional Items," between "Provisional Sums," and "dayworks"

Amend the definition of "Effective Contract Price" as follows:

"(which for the purposes of this Sub-Clause shall mean the Contract Price excluding Provisional Sums, Provisional Items and allowances for dayworks and contingencies)"

Add a final sentence as follows:

"Where the Contract provides for the payment of the Contract Price in more than one currency, the amount or proportion payable in each of the applicable currencies shall be specified when such further sum is agreed or determined, it being understood that in specifying these amounts or proportions the Contractor and the Engineer (or, failing agreement, the Engineer) shall take into account the currencies (and the proportions thereof) in which the Contractor's Site and general overhead cost of the Contract were incurred without being bound by the proportions of various currencies specified in the Appendix to Tender for payment of the Contract Price.

Clause 54

Definition of Equipment

Sub-Clause 54.9

Add the following Sub-Clause 54.9:

For the purposes of Sub-Clauses 54.5 and 54.6 the following expressions shall have the meaning hereby assigned to them:

(a) the expression "Equipment" shall mean any Contractor's Equipment, Temporary Works and materials for Temporary Works, and includes vehicles or vessels engaged in transporting these and supervisory staff and materials for the Permanent Works on the Site, but shall exclude any vehicles or vessels engaged in transporting any labour, Contractor's Equipment,

Temporary Works and materials for the Permanent Works to or from the Site:

(b) the expression "agreement for hire" shall be deemed not to include an agreement for hire purchase lease hire or other arrangement under which title in the subject matter of such agreement has passed or will or may pass to the purchaser/hirer/lessee in accordance with the provisions of such agreement, instrument, deed or arrangement.

Certificates and Payment

Clause 60

Clause 60 of the General Conditions is deleted and the following Sub-Clauses 60.1 to 60.14 are substituted therefor:

Monthly Statements

Sub-Clause 60.1

The Contractor shall submit a statement in ten copies to the Engineer at the end of each month, in a tabulated form approved by the Engineer, showing the amounts to which the Contractor considers himself to be entitled. The statement shall include the following items, as applicable, which shall be taken into account in the sequence listed:

(a) the estimated contract value of the Temporary and Permanent Works executed up to the end of the month in question, at base unit rates and prices and in local currency;

(b) the actual value certified for payment for the Temporary and Permanent Works executed up to the end of the previous month, at base unit rates and prices and in local currency;

(c) the estimated contract value at base unit rates and prices of the Temporary and Permanent Works for the month in question, in local currency, obtained by deducting (b) from (a);

(d) the equivalent of the amount set forth in (c), expressed in the various currencies in which the Contract Price in payable, and calculated by applying the proportions and the exchange rates set forth in the Appendix to Tender to the amount set forth in (c);

(e) the value of any variations executed up to the end of the month in question, less the amount

certified in the previous Interim Payment Certificate, expressed in the relevant amounts of foreign and local currencies, pursuant to Clause 52;

(f) amounts approved in respect of Daywork executed up to the end of the month in question, less the amount for Daywork certified in the previous Interim Payment Certificate, indicating the amounts of foreign and local currencies as determined from the Daywork Schedule of the Bill of Quantities;

(g) amounts reflecting changes in cost and legislation, pursuant to Clause 70, expressed in the relevant amounts of foreign and local currencies;

(h) any credit or debit for the month in question in respect of materials and Plant for the Permanent Works, in the relevant amounts, in foreign and local currencies, and under the conditions set forth in Sub-Clause 60.3;

(i) any amount to be withheld under the retention provisions of Sub-Clause 60.5, determined by applying the percentage set forth in Sub-Clause 60.5 to the amounts in foreign and local currencies due under paragraphs 60.1(d), (e), (f) and (g);

(j) any amounts to be deducted as repayment of the Advance under the provisions of Sub-Clause 60.7; and

(k) any other sum, expressed in the applicable currency or currencies, to which the Contractor may be entitled under the Contract.

Monthly Payments

Sub-Clause 60.2

The said statement shall be approved or amended by the Engineer in such a way that, in his opinion, it reflects the amounts in various currencies due to the Contractor in accordance with the Contract, after deduction, other than pursuant to Clause 47, of any sums which may have become due and payable by the Contractor to the Employer. In cases where there is a difference of opinion as to the value of any item, the Engineer's view shall prevail. Within 28 days of receipt of the monthly statement referred to in Sub-Clause 60.1, the Engineer shall determine the amounts

due to the Contractor and shall issue to the Employer and the Contractor a certificate herein called "Interim Payment Certificate", certifying the amounts due to the Contractor.

Provided that the Engineer shall not be bound to certify any payment under this Sub-Clause if the net amount thereof, after all retentions and deductions, would be less than the Minimum Amount of Interim Payment Certificates stated in the Appendix to Tender.

Notwithstanding the terms of this Clause or any other Clause of the Contract, no amount will be certified by the Engineer for payment until the performance security has been provided by the Contractor and approved by the Employer.

Materials and Plant for the Permanent Works

Sub-Clause 60.3

With respect to materials and Plant brought by the Contractor to the Site for incorporation in the Permanent Works, the Contractor shall (i) receive a credit in the month in which these materials and Plant are brought to the Site and (ii) be charged a debit in the month in which they are incorporated in the Permanent Works, both such credit and debit to be determined by the Engineer in accordance with the following provisions:

(a) no credit shall be given unless the following conditions shall have been met to the Engineer's satisfaction:

(i) the materials and Plant are in accordance with the specifications for the Works;

(ii) the materials and Plant have been delivered to the Site and are properly stored and protected against loss, damage or deterioration;

(iii) the Contractor's records of the requirements, orders, receipts and use of materials and Plant are kept in a form approved by the Engineer, and such records are available for inspection by the Engineer;

(iv) the Contractor has submitted a statement of his cost of acquiring and delivering the materials and Plant to the Site, together with such documents as may be required for the purpose of evidencing such cost; and

(v) the origin of the materials and Plant and the currencies of payment therefor are those indicated in the Appendix to Tender;

(b) the amount to be credited to the Contractor shall be the equivalent of 75 percent of the Contractor's reasonable cost of the materials and Plant delivered to the Site, as determined by the Engineer after view of the documents listed in paragraph (a) (iv) above, as determined by the Engineer;

(c) the amount to be debited to the Contractor for any materials and Plant incorporated into the Permanent Works shall be equivalent to the credit previously granted to the Contractor for such materials and Plant pursuant to Sub-Clause (b) above, as determined by the Engineer, and

(d) the currencies in which the respective amounts shall be credited or debited as set forth above shall be determined by the Engineer, provided (i) that in the case of a credit, the currencies shall be those listed in the Appendix to Tender for the relevant item of materials or Plant; and (ii) that in the case of a debit, the currencies shall be those in which the credit for the respective item of materials or Plant had been given.

Place of Payment

Sub-Clause 60.4

Payments to the Contractor by the Employer shall be made in the currencies in which the Contract Price is payable, into a bank account or accounts nominated by the Contractor.

Retention Money

Sub-Clause 60.5

A retention amounting to eight percent of the amounts due in each currency, determined in accordance with the procedure set out in Sub-Clause 60.1 (i) shall be made by the Engineer in the first and following Interim Payment Certificates.

Payment of Retention Money

Sub-Clause 60.6

Upon the issue of the Taking-Over Certificate with respect to the whole of the Works, one half of the Retention Money, or upon the issue of a Taking-Over Certificate with respect to a Section or part of the Permanent Works only such proportion thereof as the

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Engineer determines having regard to the relative value of such Section or part of the Permanent Works, shall be certified by the Engineer for payment to the Contractor.

Upon the expiration of the Defects Liability Period for the Works the other half of the Retention Money shall be certified by the Engineer for payment to the Contractor. Provided that, in the event of different Defect Liability Periods being applicable to different Sections or parts of the Permanent Works pursuant to Clause 48, the expression "expiration of the Defects Liability Period" shall, for the purpose of this Sub-Clause, be deemed to mean the expiration of the latest of such periods.

Provided also that if at such time, there shall remain to be executed by the Contractor any work ordered, pursuant to Clauses 49 and 50, in respect of the Works, the Engineer shall be entitled to withhold certification until completion of such work of so much of the balance of the Retention Money as shall, in the opinion of the Engineer, represent the cost of the work remaining to be executed.

Advance Payment

Sub-Clause 60.7

The Employer will make an interest-free advance payment to the Contractor exclusively for the costs of mobilisation in respect of the Works in an amount equivalent to twenty percent of the Contract Price named in the Letter of Acceptance, payable in the proportions of foreign and local currencies of the Contract Price. Payment of such advance amount will be due under separate certification by the Engineer after (i) execution of the Form of Agreement by the parties hereto; (ii) provision by the Contractor of the performance security in accordance with Sub-Clause 10.1; and (iii) provision by the Contractor of an unconditional bank guarantee in a form and by a bank acceptable to the Employer in amounts and currencies equal to the advance payment. Such bank guarantee shall remain effective until the advance payment has been repaid pursuant to paragraph (b) below, but the amount thereof shall be progressively reduced by the amount repaid by the Contractor as indicated in Interim Payment Certificates issued in accordance with this clause.

The advance payment shall be repaid through percentage deductions from the interim payments certified by the Engineer in accordance with this Clause. Deductions

shall commence in the next Interim Payment Certificate following that in which the total of all interim payments certified to the Contractor has reached twenty percent of the Contract Price less Provisional Sums and Provisional Items, and shall be made at the rate of thirty percent of the amount of all Interim Payment Certificates in the types and proportionate amounts of currencies of the advance payment until such time as the advance payment has been repaid; always provided that the advance payment shall be completely repaid prior to the time when 80 percent of the Contract Price has been certified for payment.

Time of Payment and Interest

Sub-Clause 60.8

The amount due to the Contractor under any Interim Payment Certificate issued by the Engineer pursuant to this Clause, or to any other term of the Contract, shall, subject to Clause 47, be paid by the Employer to the Contractor within 56 days after the Contractors's monthly statement has been submitted to the Engineer for certification or, in the case of the Final Certificate pursuant to Sub-Clause 60.13, within 84 days after the agreed Final Statement and written discharge have been submitted to the Engineer for certification. In the event of the failure of the Employer to make payment within the times stated, the Employer shall pay to the Contractor interest compounded monthly at the rates stated in the Appendix to Tender upon all sums unpaid from the date upon which the same should have been paid, in the currencies in which the payments are due.

Correction of Certificates

Sub-Clause 60.9

The Engineer may by any Interim Payment Certificate make any correction or modification in any previous Interim Payment Certificate which has been issued by him, and shall have authority, if any work is not being carried out to his satisfaction, to omit or reduce the value of such work in any Interim Payment Certificate.

Statement at Completion

Sub-Clause 60.10

Not later than 84 days after the issue of the Taking-Over Certificate in respect of the whole of the Works, the Contractor shall submit to the Engineer a Statement at Completion with supporting documents showing in detail, in the form approved by the Engineer,

(a) the final value of all work done in accordance with the Contract up to the date stated in such Taking-Over Certificate;

(b) any further sums which the Contractor considers to be due; and

(c) an estimate of amounts which the Contractor considers will become due to him under the Contract.

Estimated amounts shall be shown separately in such Statement at Completion. The Engineer shall certify payment in accordance with Sub-Clause 60.2

Final Statement

Sub-Clause 60.11

Not later than 56 days after the issue of the Defects Liability Certificate pursuant to Sub-Clause 62.1, the Contractor shall submit to the Engineer for consideration a draft final statement with supporting documents showing in detail, in the form approved by the Engineer,

(a) the value of all work done in accordance with the Contract; and

(b) any further sums which the Contractor considers to be due to him under the Contract.

If the Engineer disagrees with or cannot verify any part of the draft final statement, the Contractor shall submit such further information as the Engineer may reasonably require and shall make such changes in the draft as may be agreed between them. The Contractor shall then prepare and submit to the Engineer the final statement as agreed (for the purpose of these Conditions referred to as the "Final Statement").

If, following discussions between the Engineer and the Contractor and any changes to the draft final statement which may be agreed between them, it becomes evident that a dispute exists, the Engineer shall issue to the Employer an Interim Payment Certificate for those parts of the draft final statement which are not in dispute. The dispute shall then be settled in accordance with Clause 67. The Final Statement shall be agreed upon settlement of the dispute.

Discharge

Sub-Clause 60.12

Upon submission of the Final Statement, the Contractor shall give to the Employer, with a copy to the Engineer, a written discharge confirming that the total of the Final Statement represents full and final settlement of all monies due to the Contractor arising out of or in respect of the Contract. Provided that such discharge shall become effective only after payment due under the Final Certificate issued pursuant to Sub-Clause 60.13 has been made and the performance security referred to in Sub-Clause 10.1 has been returned to the Contractor.

Final Certificate

Sub-Clause 60.13

Within 28 days after receipt of the Final Statement, and the written discharge, the Engineer shall issue to the Employer (with a copy to the Contractor) a Final Certificate stating

(a) the amount which, in the opinion of the Engineer, is finally due under the Contract and

(b) after giving credit to the Employer for all amounts previously paid by the Employer and for all sums to which the Employer is entitled under the Contract, other than Clause 47, the balance, if any, due from the Employer to the Contractor or from the Contractor to the Employer as the case may be.

Cessation of Employer's Liability

Sub-Clause 60.14

The Employer shall not be liable to the Contractor for any matter or thing arising out of or in connection with the Contract or execution of the Works, unless the Contractor shall have included a claim in respect thereof in his Final Statement and (except in respect of matters or things arising after the issue of the Taking-Over Certificate in respect of the whole of the Works) in the Statement at Completion referred to in Sub-Clause 60.10.

Clause 63

Default of Contractor

Sub-Clause 63.1

Delete the last paragraph of this sub-clause and substitute:

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"then the Employer may, after giving fourteen days' notice to the Contractor, enter upon the Site and expel the Contractor therefrom without thereby voiding the Contract, or releasing the Contractor from any of his obligations or liabilities under the Contract, or affecting the rights and powers conferred on the Employer or the Engineer by the Contract, and may himself complete the Works or may employ any other contractor to complete the Works. The Employer or such other contractor may use for such completion so much of the Contractor's Equipment, Plant, Temporary Works and materials, which have been deemed to be reserved exclusively for the execution of the Works, under the provisions of the Contract, as he or they may think proper, and the Employer may, at any time, sell any of the said Contractor's Equipment, Temporary Works and unused Plant and materials and apply the proceeds of sale in or towards the satisfaction of any sums due or which may become due to him from the Contractor under the Contract."

Valuation at Date of Expulsion

Sub-Clause 63.2

Modify the heading of Sub-Clause 63.2 by substituting "Valuation at Date of Expulsion" for "Valuation at Date of Termination". In Sub-Clause 63.2, delete the word "termination" on the second and fifth lines and substitute: "expulsion".

Payment after Expulsion

Sub-Clause 63.3

Modify the heading of Sub-Clause 63.3 by substituting "Payment after Expulsion" for "Payment after Termination". In sub-Clause 63.3, delete the words "terminates the Contractor's employment" on the first line and substitute "shall enter and expel the Contractor".

Assignment of Benefit of Agreement

Sub-Clause 63.4

In Sub-Clause 63.4, delete the word "termination" in the second line and substitute: "expulsion".

Clause 65

Special Risks

Sub-Clause 65.2

Sub-Clause 65.2 is amended to read as follows:

"The Special Risks are the risks defined under para. (a), sub-paras (i) to (v) of Sub-Clause 20.4."

Clause 67

Settlement of Disputes

Delete the whole of Clause 67 and add Sub-Clauses 67.1 to 67.4 inclusive:

Engineers Decision

Sub-Clause 67.1

If a dispute of any kind whatsover arises between the Employer and the Contractor in connection with, or arising out of, the Contract for the execution of the Works, whether during the execution of the Works or after their completion and whether before or after repudiation or other termination of the Contract, including any dispute as to any opinion, instruction, determination, certificate or valuation of the Engineer, the matter in dispute shall, in the first place, be referred in writing to the Engineer for his decision, with a copy to the other party. Such reference shall state that it is made pursuant to this Clause. No later than the eighty-fourth day after the day in which he received such reference the Engineer shall give notice of his decision to the Employer and the Contractor. Such decision shall state that it is made pursuant to this Clause.

Unless the Contract has already been repudiated or terminated, the Contractor shall, in every case, continue to proceed with the Works with all due diligence and the Contractor and the Employer shall give effect forthwith to every such decision of the Engineer unless and until the same shall be revised, as hereinafter provided, in an amicable settlement or an arbitral award.

If either the Employer or the Contractor be dissatisfied with any decision of the Engineer, or if the Engineer fails to give notice of his decision on or before the eighty-fourth day after the day on which he received the reference, than either the Employer or the Contractor may on or before seventieth day after the day on which he received notice of such decision, or on or before the seventieth day after the day on which the said period of 84 days expired, as the case may be, give notice to the other party, with a copy for information to the Engineer of his intention to refer to the Disputes Review Board, as hereinafter provided, as to the matter in dispute. Such notice shall establish the entitlement of the party giving the same to refer to the Disputes Review Board, as hereinafter provided, as to such dispute and no procedures in respect thereof may be commenced unless such notice has been given.

If the Engineer has given notice of his decision as to a matter in dispute to the Employer and the Contractor and no notification of intention to refer to the Disputes Review Board as to such dispute has been given by either the Employer or the Contractor on or before the seventieth day after the day on which the parties received notice as to such decision from the Engineer, the said decision shall become final and binding upon the Employer and the Contractor.

Amicable Settlement

Sub-Clause 67.2

Within 60 days of the acceptance of the Tender a Disputes Review Board shall be formed to stand for the Contract Period to which either party may refer any difference or dispute in an attempt to reach an amicable settlement before resorting to arbitration.

The Board shall consist of three persons, of which both the Employer and the Contractor shall nominate one each and the third, who shall act as chairman will be mutually agreeable to both of the nominated persons and failing such agreement the Chairman shall be appointed by the Secretary General of the International Centre for Settlement of Investment Disputes.

The detailed procedure to be followed shall be decided by the Disputes Review Board within 90 days of its appointment but will be based on the rules of the published by the Institution of Civil Engineers, 1-7 Great George Streets, London, SWIP 3AA, England, Conciliation Procedure 1988 with the Disputes Review Board assuming the role of Conciliator.

If within 90 days after the date of the notice of intention to refer a dispute to the Disputes Review Board (as such notice is referred to in the third sub-paragraph of sub-clause 67.1 above) a recommendation of the Disputes Review Board for the amicable settlement of the dispute either (i) has not been made or (ii) if made, has not been accepted by both the Employer and the Contractor by notice in writing to the other party, then either the Employer or the Contractor may, within 30 days after the expiration of the above mentioned period of 90 days, give notice to the other party, with a copy for information to the Engineer of his intention to commence arbitration, as hereinafter provided as to such dispute and, subject to sub-clause 67.4, no arbitration in respect thereof may be commenced unless such notice is given.

If (i) the Disputes Review Board has given notice of its decision as to a matter in dispute to the Employer and the Contractor, and (ii) no notice of intention to commence arbitration as to such dispute has been given by either party in accordance with the provisions of the preceeding sub-paragraph of this Sub-Clause 67.2, then the said decision by the Disputes Review Board shall become final and binding upon the Employer and the Contractor.

Arbitration

Sub-Clause 67.3

Subject to Sub-Clause 67.4, any dispute in respect of which:

(i) the decision, if any, of the Engineer or Disputes Review Board has not become final and binding pursuant to Sub-Clause 67.1 or 67.2 respectively and

(ii) a notice of intention to commence arbitration has been given by either party in accordance with the provisions of Sub-Clause 67.2

shall to finally settled, unless otherwise specified in the Contract, under the Rules of Conciliation and Arbitration of the International Chamber of Commerce by one or more arbitrators appointed under such Rules. The said arbitrator/s shall have full power to open up, review and revise any decision, opinion, instruction, determination, certificate or valuation of the Engineer, notwithstanding any provision of Clause 2(1) requiring the Employer's prior written approval, related to the dispute.

Neither party shall be limited in the proceedings before such arbitrator/s to the evidence or arguments put before the Engineer or the Disputes Review Board for the purpose of obtaining his said decision pursuant to Sub-Clause 67.1. No such decision shall disqualify the Engineer or Disputes Review Board from being called as witnesses and giving evidence before the arbitrator/s on any matter whatsoever relevant to the dispute.

Arbitration may be commenced prior to or after completion of the Works, provided that the obligations of the Employer, the Engineer and the Contractor shall not be altered by reason of the arbitration being conducted during the progress of the Works.

Failure to Comply with the Decision of the Disputes Review Board

Sub-Clause 67.4

Where neither the Employer nor the Contractor has given notice of intention to commence arbitration of the dispute within the period stated in Sub-Clause 67.2 and the related decision has become final and binding, either party may, if the other party fails to comply with such decision, and without prejudice to any other rights it may have, refer the failure to arbitration in accordance with Sub-Clause 67.3. The provisions of Sub-Clauses 67.1 and 67.2 shall not apply to any such reference.

Clause 68

Notice to Employer and Engineer

Sub-Clause 68.2

For the purposes of this Sub-Clause the respective addresses are:

(a) The Employer: Bangladesh Water Development Board
WAPDA Building
Motijheel Commercial Area
Dhaka

(b) The Engineer: (to be appointed)

Clause 69

Default of Employer

In Sub-Clause 69.1, 69.4 and 69.5, substitute "Sub-Clause 60.8" for Sub-Clause 60.10".

Default of Employer

Sub-Clause 69.1

In Sub-Clause 69.1 (a), substitute "56 days" for "28 days".

Delete Sub-Clause 69.1 (d)

Clause 70

Changes in Cost and Legislation

Delete Clause 70 in its entirety and substitute:

Price Adjustment

Sub-Clause 70.1

The amounts payable to the Contractor and valued at base rates and prices pursuant to Sub-Clause 60.1 (d), (e) and (f) shall be adjusted in respect of the rise or fall in the cost of labour, Contractor's Equipment, Plant, materials and other inputs to the

Works, by the addition or subtraction of the amounts determined by the formulae prescribed in this Clause.

Other Changes in Cost

Sub-Clause 70.2

To the extent that full compensation for any rise or fall in costs to the Contractor is not covered by the provisions of this or other Clauses in the Contract, the unit rates and prices included in the Contract shall be deemed to include amounts to cover the contingency of such other rise or fall of costs.

Adjustment Formulae

Sub-Clause 70.3

The amount to be added or deducted from the Interim Payment Certificates in respect of changes in cost and legislation shall be determined the following manner:

For payment in local currency, according to the following formula:

$$PLn = 0.05 + 0.95 \frac{In}{Io}$$

Where:

PLn is the adjustment factor to be applied to the local currency component of the estimated value of the work carried out in month "n" determined in accordance with Sub-Clause 60.1 (d), (e) and (f).

Io is the Construction Cost General Index published by the Bangladesh Bureau of Statistics prevailing on the day 28 days prior to the closing date for submission of bids, and In is the same index prevailing on the day 28 days prior to the last day of the period to which a particular Interim Payment Certificate is related.

For payment in foreign currency, according to the following formula:

$$PFn = a + b \frac{Ln}{Lo} + C \frac{Mn}{Mo} + d \frac{En}{Eo}$$

Where:

"PFn" is the adjustment factor to be applied to the foreign currency component of the estimated value of the work carried out in month "n", determined in accordance with Sub-Clause 60.1 (d), (e) and (f);

"a" is a fixed coefficient, specified in the Appendix to Tender, representing the nonadjustable portion in contractual payments; "b", "c", "d", are coefficients representing the estimated proportion of each cost element (labour, materials, and Contractor's Equipment) in the Works or sections thereof, net of Provisional Sums and Provisional Items, as entered in the Appendix to Tender;

"Ln", "Mn", "En", are the current cost indices or reference prices for month "n", determined pursuant to Sub-Clause 70.5, applicable to each cost element; and

"Lo", "Mo", "Eo", are the base cost indices or reference prices corresponding to the above cost elements at the date specified in Sub-Clause 70.5.

Sources of Indices

Sub-Clause 70.4

The sources of indices shall be those listed in the Appendix to Tender, as approved by the Engineer.

Base, Current and Provisional Indices

Sub-Clause 70.5

The base cost indices or prices shall be those prevailing on the day 28 days prior to the closing date for submission of bids. Current indices or prices shall be those prevailing on the day 28 days prior to the last day of the period to which a particular Interim Payment Certificate is related. If at any time the current indices are not available, provisional indices as determined by the Engineer will be used, subject to subsequent correction of the amounts paid to the Contractor when the current indices become available.

Adjustment after Completion

Sub-Clause 70.6

If the Contractor fails to complete the Works within the time for completion prescribed under Clause 43, adjustment of prices thereafter until the date of completion of the Works shall be made using either the indices or prices relating to the prescribed time for completion, or the current indices or prices, whichever is more favorable to the Employer, provided that if an extension of time is granted pursuant to Clause 44 the above provision shall apply only to adjustments made after the expiry of such extension of time.

Weightings

Sub-Clause 70.7

The weightings for each of the factors of cost given in the Appendix to Tender shall be adjusted if, in the opinion of the Engineer, they have been rendered unreasonable, unbalanced or inapplicable as a result of varied or additional work already executed or ordered under Clause 51 or for any other reason.

Subsequent Legislation

Sub-Clause 70.8

If, after the date 28 days prior to the latest date for submission of tenders for the Contract there occur in the country in which the Works are being or are to be executed changes to any National or State Statute, Ordinance, Decree or other Law or by-law which causes additional or reduced cost to the Contractor, other than under the preceding Sub-Clauses of this Clause, in the execution of the Contract, such additional or reduced cost shall, after due consultation with the Employer and the Contractor, be determined by the Engineer and shall be added to or deducted from the Contract Price and the Engineer shall notify the Contractor accordingly, with a copy to the Employer.

Notwithstanding the foregoing, such additional or reduced cost shall not be separately paid or credited if the same shall already have been taken into account in the indexing of any inputs to the Price Adjustment Formulae in accordance with the provisions of Sub-Clauses (1) to (7) of this clause.

Clause 72

Currency Proportions

Sub-Clause 72.2

Delete the words from " ..prevailing .." to the end of the sentence, and substitute:

"..stated in the Appendix to Tender.

"The foreign and local currency portions of the balance of the Contract Price shall be amended by agreement between the Employer and the Contractor to reflect any substantial changes in the expected foreign and local currency requirements of the Contractor during the execution of the Works, provided that

(a) the Contractor shall inform the Employer and the Engineer whenever any such substantial change may occur; or

(b) the Engineer may recommend a review of such expected requirements if in his judgement there is evidence of a change in the country of origin of materials, Plant or services to be provided under the Contract which should result in any substantial change of such expected requirements."

Taxation

Clause 73

Foreign Taxation

Sub-Clause 73.1

The prices bid by the Contractor shall include all taxes, duties and other charges imposed outside the Employer's country on the production, manufacture, sale and transport of the Contractor's Equipment, Plant, materials and supplies to be used on or furnished under the Contract, and on the services performed under the Contract.

Local Taxation

Sub-Clause 73.2

The prices bid by the Contractor shall include all customs duties, import duties, business taxes, income and other taxes that may be levied in accordance with the laws and regulations in being as of the date 28 days prior to the closing date for submission of bids in the Employer's country on the Contractor's Equipment, Plant, materials and supplies (permanent, temporary and consumable) acquired for the purpose of the Contract and on the services performed under the Contract. Nothing in the Contract shall relieve the Contractor from his responsibility to pay any tax that may be levied in the Employer's country on profits made by him in respect of the Contract.

Income Taxes on Staff

Sub-Clause 73.3

The Contractor's staff, personnel and labour will be liable to pay personal income taxes in the Employer's country in respect of such of their salaries and wages as are chargeable under the laws and regulations for the time being in force, and the Contractor shall perform such duties in regard to such deductions thereof as may be imposed on him by such laws and regulations.

Duties on Contractor's Equipment

Sub-Clause 73.4

Notwithstanding the provisions of sub-Clause 73.2, Contractor's Equipment, including essential spare parts therefor, imported by the Contractor for the

sole purpose of executing the Contract shall be exempt from the payment of import duties and taxes upon importation.

Clause 74

Bribes

Sub-Clause 74.1

If the Contractor, or any of his Subcontractors, agents or servants gives or offers to give to any person any bribe, gift, gratuity or commission as an inducement or reward for doing or forbearing to do any action in relation to the Contract or any other contract with the Employer, or for showing or forbearing to show favor or disfavor to any person in relation to the Contract or to any other contract with the Employer, then the Employer may enter upon the Site and the Works and expel the Contractor and the provisions of Clause 63 hereof shall apply as if such entry and expulsion had been made pursuant to that clause.

Clause 75

Termination of Contract for Employer's Convenience

Sub-Clause 75.1

The Employer shall be entitled to terminate this Contract at any time for the Employer's convenience after giving 56 days prior notice to the Contractor, with a copy to the Engineer. In the event of such termination, the Contractor

(a) shall proceed as provided in Sub-Clause 65.7; and

(b) shall be paid by the Employer as provided in Sub-Clause 65.8.

Clause 76

Restrictions on Eligibility

Sub-Clause 76.1

(a) Any Plant, supplies or materials which will be incorporated in the Works, as well as the Contractor's Equipment, shall have its origin in eligible source countries as defined in the IBRD Guidelines for Procurement.

(b) Such Plant, supplies, materials or Contractor's Equipment shall be transported by carriers from such eligible source countries, unless exempted by the Engineer in writing, on the basis of

potential excessive costs or delays.

(c) Surety, insurance and banking services shall be provided by insurers and bankers from such eligible source countries.

Clause 77

Joint and Several Liability

Sub-Clause 77.1

If the Contractor is a joint venture of two or more persons, all such persons shall be jointly and severally bound to the Employer for the fulfillment of the terms of the Contract and shall designate one of such persons to act as a leader with authority to bind the joint venture. The composition or the constitution of the joint venture shall not be altered without the prior consent of the Employer.

Clause 78

Sub-Clause 78.1

Details to be Confidential

The Contractor shall treat the details of the Contract as private and confidential, save insofar as may be necessary for the purposes thereof, and shall not publish or disclose the same or any particulars thereof in any trade or technical paper or elsewhere without the previous consent in writing of the Employer or the Engineer. If any dispute arises as to the necessity of any publication or disclosure for the purpose of the Contract the same shall be referred to the decision of the Employer whose award shall be final.

BRAHMAPUTRA RIGHT BANK PHASE 1 WORKS

SECTION 4: SPECIFICATION

SPECIFICATION

PART 1 - DESCRIPTION OF WORKS

Location and Description of the Project

101 The Works to be constructed under this contract are to be located on the west, or right, bank of the Brahmaputra River (locally known as the Jamuna River) in the Peoples's Republic of Bangladesh. They form part of a long term strategy to improve the reliability of flood alleviation measures on the west bank and to safeguard important infrastructure. Financing for this contract is being provided by credit from the <**funding agency**>.

Scope of Contract

102 The principal component of the Works to be executed under the Contract is the construction of bank stabilization structures at <**location**> and <**location**> comprising precast concrete block armoured revetments laid on geotextile filter (300 m of straight revetment plus upstream and downstream terminations) and falling aprons. As an alternative to precast concrete block armouring, rock armouring may be used. The Contract includes the construction of cross-bars to the revetments at <**location**> and <**location**> and the provision of berthing and mooring facilities for local (country) boats. The landward end of the cross-bars will be connected to retired lengths of the Brahmaputra Right Embankment, to be constructed by others.

The Works have been planned and designed on the basis of topographic and bathymetric surveys undertaken from <**dates of surveys**>. As the Brahmaputra river has a very unstable braided channel, significant changes are expected to have occurred between these surveys and the Commencement Date. Before construction of the revetments commences, therefore, the Contractor shall undertake further topographic and bathymetric surveys at the location of the Permanent Works, as directed by the Engineer, to provide requisite data for the finalisation of the design to suit the actual conditions pertaining at the time. Such surveys shall be completed not less than 26 weeks prior to the programmed commencement of construction in the river.

The layout of the works and the depth at which the falling apron is to be constructed as shown on the Drawings shall therefore be considered as indicative only. It is to be anticipated that changes to the location and possibly to the planform of the revetments at <**location**> and <**location**> will be necessary.

The Contractor shall construct offices and accommodation and provide the facilities for the Engineer and his staff as set out in Clauses 235,236 and 237 hereof.

In addition the Contractor shall construct, at a location or locations to be approved by the Engineer, such accommodation, plantyard, workshops, offices, housing and camps for himself, his staff and employees as the Contractor considers appropriate.

Contract Drawings

103 The Works are shown on the Drawings listed in Appendix F.

Working Areas

104 The land acquired by the Employer for the construction of the Permanent Works lies within the limits shown on the Drawings. It shall be made available to the Contractor for the execution of the Works free of charge.

The Contractor shall make his own arrangements, obtain any necessary permission and be solely responsible for paying any costs, charges or compensation for the use of any areas outside the boundaries of the Working Area shown on the Drawings which he may need in connection with the execution of the Works.

Possession of Site

105 In amplification of Clause 42.1 of the Conditions of Contract, the Contractor shall be given possession of the Site on the Commencement Date.

Workmanship and Materials in General

201 All workmanship shall be of the best quality appropriate to each category of work. Except where otherwise stated or approved by the Engineer, all materials and equipment used in the Works shall be of the best quality of their respective kinds as specified or described in the Specification, Drawings and Bills of Quantities.

Standards and Alternative Standards

202 Materials, equipment and methods shall comply with the standards indicated, generally the relevant British Standards and Codes of Practice published by the British Standards Institute, 2 Park Street, London W1A 2BS, England, or alternative standards as described below.

The Contractor shall supply two sets of the relevant British, DIN, ISO and ASTM Standards listed in Appendix H or alternatively specified and approved standards (in the English language) to the Engineer within 90 days from the Commencement Date. On completion of the Contract these Standards shall become the property of the Employer.

Wherever reference is made in the Contract to specific standards and codes to be met by the goods and materials to be furnished, and work performed or tested, the provisions of the latest current edition or revision of the relevant standards and codes in effect shall apply, unless otherwise expressly stated in the Contract. Where such standards and codes are national, or relate to a particular country or region, other authoritative standards which ensure an equal or higher quality than the standards and codes specified will be accepted subject to the Engineer's prior review and written approval. Difference between the standards specified and the proposed alternative standards must be fully described in writing by the Contractor and submitted to the Engineer at least 28 days prior to the date when the Contractor desires the Engineer's approval. In the event the Engineer determines that such proposed deviations do not ensure equal or higher quality, the Contractor shall comply with the standards specified in the documents.

Alternative Materials and Equipment

203 The Contractor may propose, for the Engineer's approval, alternative materials or equipment to those specified, provided either:-

(i) they are of at least equal quality and performance; or

(ii) they are of like quality and performance and comply with approved alternative standards.

If alternative materials or equipment are proposed, the Contractor shall submit comprehensive details including technical descriptions, drawings and specifications to demonstrate that the alternative complies with either requirement of this Clause. The Contractor shall allow for the time necessary for review and approval of such alternative by the Engineer.

Manufacturers' Instructions

204 Materials and equipment shall be used or installed where relevant in accordance with the instructions of the manufacturer unless otherwise required.

Supply of Materials

205 (1) As soon as possible after the Contract has been awarded, the Contractor shall submit a list of suppliers from whom he proposes to purchase the materials and equipment required for the works. Samples shall be taken and tested in accordance with the relevant standards where applicable. Materials and equipment sources and suppliers shall not be changed without prior written approval of the Engineer.

(2) The Contractor is encouraged to use locally produced materials in preference to imported materials provided that they comply with the Specification and are available in sufficient and timely quantities.

(3) The country of origin of imported materials shall comply with Clause 76 of the Conditions of Contract.

Copies of Orders

206 The Contractor shall, if required, by the Engineer, submit to him copies of orders for materials and equipment to be incorporated in the Permanent Works.

Test Certificates

207 Unless required otherwise in this Specification, the Contractor shall supply works test certificates, analyses, etc as relevant to the particular materials and as required by relevant standards etc. Where necessary certified copies in the English language shall also be provided.

Inspection of Materials

208 (1) The Engineer may employ an inspecting engineer to inspect materials for the Works at the suppliers' premises or elsewhere, and in this capacity the inspecting engineer will be regarded as the Engineer's Representative within the limitation imposed by Clause 2 of the Conditions of Contract.

(2) Whenever work is to be done at a time when work is not usually in progress, or whenever the regular period of carrying on such work is changed, the Engineer shall be given notice in sufficient time to arrange for proper inspection.

Quality Assurance

209 The Contractor shall document and maintain Quality Assurance procedures complying with BS 5750.

The Contractor shall prepare a Quality Plan for the Works which shall be submitted to the Engineer for approval within 30 days of Commencement Date. The Quality Plan shall be reviewed, updated and resubmitted for approval as necessary throughout the Contract period.

The Contractor shall not commence any item of permanent work until he has submitted to the Engineer a written statement of his proposed procedure for his own inspection of that item, recording such inspection and obtaining the Engineer's written approval thereof. Every such statement shall identify the individuals on the Contractor's staff who are responsible for inspecting the workmanship and/or testing the material for the item in question.

The Contractor shall provide all necessary access to the Works and to records to enable the Engineer to assess the Contractor's Quality Plan and Quality Assurance procedures.

Tolerances

210 All Works shall be constructed to the tolerances shown in Appendix A.

Fences

211 (1) The Contractor shall erect and maintain at his own expense suitable and approved temporary fencing to enclose such areas of the Works to be carried out and all areas of land occupied by the Contractor within the Site as may be necessary to implement his obligations under Sub-Clauses 19.1 of the Conditions of Contract. Where any temporary fence has to be erected alongside a public road, footpath, etc., it shall be to the satisfaction of the authority concerned.

(2) The Contractor shall fence his housing and other compounds in a manner approved by the Engineer.

Existing Services

212 (1) The Contractor shall consult all relevant authorities and before commencing any excavations and shall satisfy himself as to the exact position of existing services which affect or may be affected by the Works and shall give written notification of the same to the Engineer.

(2) The Contractor shall execute the Works in such a manner that he does not damage or interfere with existing services on or near the site. If damage or interference is so caused the Contractor shall make his own arrangements, to the approval of the Engineer and the relevant authority, to execute the repairs at his own cost.

(3) The Contractor shall make his own arrangements for any diversion or removal of services, which he may require for his own convenience or method of working, and shall obtain the prior approval of the Engineer to such arrangements. Such work shall be undertaken at the Contractor's own cost.

Services for Site Use

213 (1) The Contractor shall arrange at his own cost the supply of electricity, fresh water, telephone, compressed air and other services as necessary to the Permanent Works, Temporary Works and his Site establishment and shall provide, maintain and remove on completion all pipes, cables and fittings which carry such services to his operations.

(2) The Contractor shall provide an adequate supply of safe drinking water on the Site. The quality, number, capacity and location of the installations shall be to the satisfaction of the Engineer, and conform with the requirements of the appropriate authorities. The Contractor shall satisfy himself regarding the adequacy of any existing water supply facilities to the Site and shall provide such additional arrangements as are necessary to supplement the existing facilities.

(3) All electrical installations forming part of the Temporary Works shall comply with the relevant provisions of the latest current edition of the Regulations for Electrical Installations (IEE Wiring Regulations) published by the Institution of Electrical Engineers.

Sanitary Conveniences

214 Sanitary conveniences for the use of persons employed on the Works shall be provided and maintained by the Contractor in accordance with the appropriate regulations. All persons engaged upon the Works shall be required to use them. The Contractor shall provide and maintain temporary arrangements for the proper disposal of sewage, waste and drainage from or in connection with the Works.

Materials on and under the Site

215 All materials obtained in the excavations, clearing of the Site of the Works and soil stripping, shall belong to the Employer and shall not be removed from the Site without the consent of the Engineer. The Contractor may, however, use for the construction of the Works any of the materials excavated under the Contract which the Engineer may determine to be fit for such use and shall use such materials if directed by the Engineer.

Drains, Streams, Watercourses etc.

216 Drains, pipes, canals, channels, watercourses or streams affected by the Contractor's operations shall be reinstated to their original condition. The Contractor shall notify the Engineer in writing 14 days in advance of his intention to start any part of the Works affecting watercourses, canals, streams, drains, pipes, channels etc. The Contractor shall be responsible for maintaining the watercourses within the Site in effective working condition. The Contractor shall take all practicable measures (which shall be subject to the prior approval of the Engineer) to prevent the deposition of silt or other materials from his operations in such watercourses.

The Contractor shall not discharge into any watercourse oil, noxious or floating materials or untreated waterborne effluent.

Keeping the Works Free from Water

217 Except where underwater construction is required the Contractor shall execute all work in the dry, and shall construct any temporary drains, watercourses, pumping systems, and other works that may be necessary for the purpose.

Slips

218 The Contractor shall make good any damage or defect caused by slips to any cuttings, excavations or embankments on the Site and shall do all necessary work to prevent or remedy the same.

Protection of Completed Work

219 The Contractor shall protect completed work from damage during subsequent operations, from the weather or any other cause, including the naturally aggressive nature of the environment in

which the Works are to be constructed and make good any damage so arising.

Access

220 The Contractor shall be entirely responsible for providing all access to Site for personnel, material supplies, vehicles, constructional plant and for all other requirements for the execution of the Works.

Access to the Site can only be along the navigable channels of the Brahmaputra river and the public roads shown on the Drawings or approved by the Engineer in writing. No access shall be permitted along the existing flood embankment unless specifically authorised by the Engineer in writing.

The Contractor shall abide by all limitations, laws and regulations relating to the use of the public roads and waterways. In general, construction traffic shall avoid the centre of towns.

The Contractor shall ensure that damage to any public roads, tracks, foothpaths and flood embankments used by any vehicles or plant proceeding to or from the Site is kept to a minimum and he shall be responsible for the cost of all repairs necessary to restore such roads, tracks, footpaths and flood embankments to the satisfaction of the Engineer and Statutory Authorities.

The Contractor may improve and/or widen existing roads, repair or strengthen existing bridges or culverts, and widen and/or deepen existing waterway routes to meet his haulage requirements, provided that such works will be so scheduled and conducted as to minimise disturbance to other users, and subject to the approval of the Engineer and the Statutory Authorities.

The Contractor shall provide the Engineer with full details in writing of any such improvements not less than 28 days prior to the date on which he intends to commence the work. The details shall include information on the Plant that will make use of the improved route. Notwithstanding this provision, the Contractor shall be solely responsible for obtaining the necessary approval from the relevant authority and for the proper construction and maintenance of the works at his own cost.

Should the Contractor require any other form or route of access not provided for under the

Contract, he shall make his own arrangements, obtain any necessary permission, and be solely responsible for payment of any costs, charges or compensation in connection therewith.

The provisions of this Clause in no way limit or modify the Employer's obligation to give possession of the site in accordance with Clause 42.1 of the Conditions of Contract.

Surface and River Bed Levels

221 Before commencing work on any section of the Works, the Contractor shall survey the original or prepared ground surface and river bank surface above Low Water Level + 2.00 m and shall prepare and submit to the Engineer plans and sections for agreement.

The survey of the river bed below Low Water Level + 2.00 m shall be undertaken at a time as close as practicable to the commencement of the respective section of the work. The permissible time between survey and the commencement of work at any location will vary depending on the rate of change of the river bed levels but shall in no case be longer than that which may result in a change of level through natural processes that exceeds the tolerances set out in Appendix A for that type of work.

Contractor Responsible for Sufficiency of Means Employed

222 The Contractor shall take upon himself the full and entire responsibility for the sufficiency of plant, centering, timbering, machinery, tools or implements and generally for all means used for the fulfilment of the Contract. In the event of any of these means proving insufficient, the Contractor is still fully and entirely responsible for the sufficiency of these means notwithstanding any previous approval or recommendation that may have been given by the Engineer.

The Contractor shall make due allowance regarding plant capacity and output for the seasonal working which will be imposed by river flow and climatological conditions.

Safety of Adjacent Structures or Works

223 In pursuance of Clause 222 hereof the Contractor shall at his own expense provide and erect to the approval of the Engineer such supports as may be required to protect efficiently all structures or works which may be endangered by the execution of the Works and he shall remove such supports on completion of the Works or otherwise take such permanent measures as may be required by the Engineer to protect the structures or works.

Interference with Existing Works

224 The Contractor shall not interfere in any way with any existing works whether the property of the Employer or of a third party and whether the position of such works is indicated to the Contractor by the Engineer or not, except where such interference is specifically described as part of the Works either in the Contract or in the Engineer's instructions.

Abatement of Nuisance

225 The Contractor shall adopt such measures as the Engineer may consider reasonable and necessary to minimise nuisance from dust, noise, or other cause.

Testing

226 The Contractor shall provide all staff, labour and equipment necessary for the performance of all tests required. The equipment, staff and method of operation shall be to the approval of the Engineer, and the Engineer shall have access to the Contractor's laboratory(ies) at all reasonable times.

The Contractor shall obtain the approval of the Engineer for his proposed testing arrangements and shall submit all test results without delay.

Samples to be Supplied

227 In accordance with the provisions of Clause 36 of the Conditions of Contract, the Contractor shall as directed by the Engineer supply samples of materials to be incorporated in the Works. The samples required for approval shall be submitted by the Contractor in labelled boxes and in sufficient time for testing, due allowance being made for the fact that if samples are rejected further samples and testing will be required.

Assistance to the Engineer

228 (1) The Contractor shall provide for the exclusive use of the Engineer all instruments (which shall be new or in proven good condition), appliances, protective clothing including rubber boots, and labour required for checking the setting out of the Works, testing, inspection and for any other attendance on the Engineer. A schedule of the basic equipment requirement is given in Appendix D to this Specification.

(2) The Contractor shall provide drivers, chainmen, boatmen, additional laboratory assistants or labourers to assist the Engineer in carrying out his duties. Such personnel shall be under the sole direction of the Engineer.

Photographs

229 Progress colour photographs shall be taken at such times and of such portions of the Works as the

Engineer may require. The Contractor shall supply a set of photographs comprising the negative and five colour prints of an overall size of 250 mm x 200 mm suitably inscribed in English. The Contractor shall provide suitable albums for mounting the prints. Each set shall be provided to the Engineer within 14 days of being taken. The negatives of the photographs and all prints shall be the property of the Employer and no prints from these negatives may be supplied to any person or persons except with the written authority of the Employer or the Engineer.

Video Record of Construction

230 The Contractor shall make a video record of the Works, providing suitable video recording equipment and supplying video cassettes as directed by the Engineer.

Construction progress shall be recorded at monthly intervals, with filming undertaken from standard stations to be agreed with the Engineer. A record shall also be made of specific construction operations determined by the Engineer, to demonstrate methods and rates of working.

Construction progress and specific construction operation records at each site are to be kept on separate tapes and each record sequence shall titled and dated. Upon completion of the Works the Contractor, in conjunction with the Engineer, shall edit the record tapes and produce a complete video film of the construction works.

Contractor's Accommodation

231 The Contractor shall make his own arrangements for acquiring any land outside the Working Area shown on the Drawings that is required in order to establish the office, housing, plantyard, stores, berthing, loading and unloading facilities, precasting and other areas, accommodation and camp for himself and his employees.

The Contractor shall provide, erect, service and maintain all necessary buildings as offices, housing or plantyard/stores for himself, his staff and his employees and all other facilities required for the execution of the Works. These buildings and facilities shall, from the time of their erection until the completion of the Contract, be the property of the Employer and the Contractor shall not demolish or remove any buildings or facilities or parts thereof without the written permission of the Engineer.

The Contractor shall submit for the prior approval of the Engioneer, his proposals for the layout of his working area and other facilities which shall comply with the appropriate Bangladeshi regulations. The Contractor shall be responsible for obtaining the necessary approvals from the competent Authorities prior to the commencement of construction. The Contractor shall construct and maintain adequate roads or paths to all buildings, and shall make all necessary arrangements for services as specified herein.

All hutments, buildings, fixtures and fittings provided under this Clause and all materials, plant, equipment or any debris shall be removed and the site reinstated to the satisfaction of the Engineer at the end of the Contract.

Contractor's Transport

232 The Contractor shall make his own arrangements for the transport of his staff and workmen to and from the sites of the Works.

Fire Protection

233 The Contractor shall construct, equip and administer at his cost fire points in such positions and of such size as will provide an adequate service for the protection against fire of all buildings, stores and property on the Site.

Acquisition of Contractor's Facilities

234 Notwithstanding the obligation of the Contractor to remove all temporary facilities, the Employer reserves the right to acquire some or all of the above facilities at rates and prices to be determined in accordance with Clause 52 of the General Conditions of Contract.

Facilities for the Engineer

235 The Contractor shall make his own arrangements for acquiring any land, with access, outside the Working Area shown on the Drawings that is required in order to establish the offices and laboratories for the Engineer and his staff and housing and recreational facilities for staff and their dependents. Such land shall be in close proximity to the Contractor's own respective facilities. The land and access roads shall be sufficiently elevated and drained so as to ensure that they remain out of risk of inundation, and shall be sited remote from areas of potential bank erosion.

The Contractor shall provide and maintain all-weather access suitable for two-wheel drive saloon vehicles for all permanent housing, offices and laboratory facilities provided for the Engineer.

The Contractor shall prepare for the Engineer's approval, working drawings of all the facilities to be provided for the Engineer, including but not limited to the site layouts, front and side elevations, floor plans with dimensions, details of construction and finishes, details of fittings and furnishings and all other data as required for the completion of the facilities in accordance with the Specification.

The Contractor shall provide 24 hour security for all facilities provided for the Engineer to the satisfaction of the Engineer.

The Contractor shall be responsible for providing and maintaining to the satisfaction of the Engineer all services to the facilities provided for the Engineer, including telecommunication, potable water, gas, electricity, sewerage and solid waste disposal. Adequate provision shall be made to ensure continuity of supply of all services independent of other agencies. The design of the disposal system for waste water shall take due account of the conditions to be expected through all seasons of the year.

All facilities provided for the Engineer shall be removed by the Contractor at the end of the Contract or at such earlier time that the Engineer shall signify that they are no longer required.

Accommodation for the Engineer

236 The Contractor shall provide, equip and maintain for the sole use of the Engineer and his staff the office and living accommodation specified in Appendix B to the Specification. All such accommodation shall be completed and furnished within 26 weeks of the commencement of work on site.

The Contractor shall provide temporary office and single-status living accommodation for the Engineer and his staff from the date of the start of work on Site and shall maintain and service such accommodation until such time as the permanent accommodation is completed and furnished to the satisfaction of the Engineer. Such temporary office and living accommodation shall be to a standard consistent with the main facilities to be provided and shall be subject to the approval of the Engineer.

At each place of working the Contractor shall provide separate office accommodation to the Engineer's approval for work inspectors.

Engineer's Testing Laboratory

237 The Contractor shall provide, equip and maintain for the Engineer's use the testing laboratory specified in Appendix B to the Specification. The laboratory shall be complete, including the supply of all the required equipment as defined in Appendix E, to the satisfaction of the Engineer at least 8 weeks prior to the commencement of construction of the Permanent Works.

If the Contractor fails to complete the Laboratory Facilities by the required date, the Engineer reserves the right to carry out any sampling and laboratory testing in any other laboratory designated by the Engineer and to deduct any fees and charges so arising from the amounts due to the Contractor.

The Contractor shall provide all necessary labour and laboratory assistants required by the Engineer for the efficient running of the laboratory but the management of the laboratory shall be by the Engineer.

The existence of the Engineer's Testing Laboratory shall in no way relieve the Contractor of his responsibility for carrying out his own tests in order to maintain the degree of control of quality hereinafter specified.

Maintenance of the Engineer's Facilities

238 The Contractor shall at all times be responsible for maintaining the facilities in an acceptable condition and shall provide replacement equipment and furnishings where required by the Engineer while repairs are being undertaken. Disposable and consumable supplies shall at all times be kept replenished.

Maintenance work by the Contractor shall generally be scheduled so as to cause minimum interference and inconvenience to the Engineer and his staff. In the case of offices and laboratories, the work shall generally be undertaken outside of the normal working hours of the Engineer and his staff.

Telecommunications

239 The Contractor shall provide, install and maintain the telecommunication facilities in accordance with the Specificationin Appendix G which shall serve both the Engineer's and the Contractor's facilities.

Engineer's Transport

240 The Contractor shall provide suitable licensed and insured land and water transport of the

size and type stated in Appendix C to the Specification for the exclusive and full-time use of the Engineer and his staff for the duration of the Contract.

The Contractor shall provide competent drivers and boatmen, maintain, clean and fuel the transport which will revert to the Contractor's ownership upon completion of the Contract. Allowance shall be made for personnel to work shifts.

Temporary Works

241 The Contractor shall be responsible for the design, specification, execution and subsequent removal of all Temporary Works necessary for the completion of the Works. Temporary Works shall be designed by the Contractor in accordance with the Standards described elsewhere in this Specification or as agreed with the Engineer.

It is emphasised that the Contractor is responsible for the design of Temporary Works required to provide a suitable working environment in which to construct the works below water level.

Before the Contractor starts construction on any part of the Temporary Works he shall furnish the Engineer with complete drawings and, if so required, calculations relating to stability, strength and deflections of that part of the Temporary Works.

The required submission of drawings and/or calculations shall be made to the Engineer a reasonable period before the Contractor intends to commence any fabrication or installation of Temporary Works. The Contractor shall make due allowance in his programme for submission of temporary works proposals, review by the Engineer and amendment, resubmission and further review by the Engineer as may be necessary until the consent of the Engineer to the proposals is obtained.

"Directed" and "Approved"

242 The terms "directed" and "approved" in the Specification mean "directed by the Engineer" and "approved by the Engineer" except where the context clearly implies another meaning.

Low Water Level and High Flood Level

243 The term Low Water Level (LWL) means the river low water level having a two year return period as estimated using a 1-D hydrodynamic model and the best available data at the time of preparing the Drawings. The High Flood Level (HFL) has similarly been estimated for a high river level having a 100

year return period assuming that the Jamuna Multipurpose Bridges has been constructed.

These terms are used for reference purposes only and the Contractor shall be responsible for making his own estimates of the probability of stage and flow occurrence for the purposes of planning and executing the Works.

Notices to Mariners

244 The Contractor shall arrange for the publication of all "Notices to Mariners" which may be required in respect of the Works, accordance with the Inland Waterways Transport Authority's requirements.

Navigation

245 The Contractor shall ensure safe passage for other vessels and shall liaise with the Inland Waterways Transport Authority as necessary to maintain navigation, and shall provide all buoys, markers, lights etc. that may be required.

Protective Clothing and Equipment

246 The Contractor shall provide and maintain all necessary protective clothing and equipment, including safety nets and harnesses as required, and, where work is in progress in, on or near water, life preservers and rescue boats.

Training of Employer's Staff

247 The Contractor shall be responsible for the practical training of staff assigned by the Employer in the use of specialised instrumentation and equipment of the kind to be used later for monitoring, operation and maintenance of the completed Works. Instructions will be given during the course of construction. Payments for training will be made only upon the Engineer's certification that a satisfactory standard of training has been provided.

Liaison with Public Authorities

248 The Contractor shall establish and maintain close liaison and attend regular meetings with public authorities and other concerned parties to ensure the smooth running of all aspects of construction which affect the public interest.

Explosives and Blasting

249 The Contractor shall store explosives in a licensed store or magazine and a separate building for detonators all to the approval of the appropriate authorities. He shall obtain all necessary permits and take all precautions required by the authorities during transport of the explosives. Explosives shall be handled only by currently licensed shot firers. The Contractor shall ensure that there is no unauthorised issue or improper use of explosives brought onto the Site and shall maintain a strict check on quantities

issued and consumed. He shall maintain a register of explosives received and issued, which shall be available for the Engineer's inspection.

Explosives shall be used in the quantities and manner recommended by the manufacturers. The written consent of the Engineer shall be obtained on each occasion that the Contractor wishes to use explosives.

When blasting is to be carried out the Contractor shall determine the likely extent of the danger zone and ensure, by the use of heavy blasting mats when necessary to prevent fly-rock, that no damage is caused to persons or property on or off the Site. Guards shall be posted to prevent access to the danger zone and a warning siren shall be sounded prior to firing.

Where blasting is proposed adjacent to a building or other structure, existing or under construction and being part of or outside the Works, the Contractor shall satisfy the Engineer, by preliminary site trials, that safe values of vibrational amplitude and particle velocity will not be exceeded.

SPECIFICATION
PART 3 - DRY EARTHWORKS

Site Clearance

301 The Contractor shall clear the Site above LWL + 2.00 m as required by removing vegetation, debris, brickbats, porcupines, trees, demolishing and removing buildings, etc. and the like to approved locations either on or off the Site as directed.

Stumps and major roots shall be grubbed out and all combustible material arising shall be gathered into windrows and burnt. The Contractor shall take precautions to prevent the spread of fire to adjacent land.

Notwithstanding the provisions of this Clause, the Contractor shall preserve established grass cover on existing embankments that fall within the Site but which have been designated on the drawings or as may be directed by the Engineer for retention in their present state.

Site Survey

302 Prior to the commencement of each type of excavation or filling including stripping the Contractor shall carry out a survey of the existing ground surface in conjunction with the Engineer to establish the commencing surface for the purpose of measurement of quantities. Levels shall be taken at intervals of not more than 10 m measured horizontally on a rectangular grid unless directed otherwise.

The results shall be plotted by the Contractor on plans and sections and copies of these shall be submitted to the Engineer for his approval and subsequent use in measurement.

Definitions of Dry Earthworks and Earthworks Materials

303 Dry earthworks are defined as excavation and/or filling above LWL + 2 m, other than the placing of hydraulic fill.

The following definitions of earthworks materials shall apply to this and other clauses of the Specification in which reference is made to the defined materials:-

(i) 'top soil' shall mean the top layer of soil containing a higher proportion of organic material.

(ii) 'suitable material' shall comprise all that material which arises from

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excavations within the Site and which is approved by the Engineer as acceptable for use in the Works.

(iii) 'unsuitable material' shall mean other than suitable material and shall comprise:

(a) material from swamps, marches and bogs or other material with a high organic content;

(b) peat, logs, stumps and perishable materials;

(c) material susceptible to spontaneous combustion:

(d) clay of liquid limit exceeding 90 and/or plasticity index exceeding 65.

(iv) 'soft' material shall mean all material other than that defined as rock hereunder.

(v) 'rock' shall mean any hard natural or artificial material requiring the use of blasting or approved pneumatic tools for its removal.

Top Soil Stripping

304 Where directed by the Engineer, top soil shall be removed and deposited in separate heaps for re-use, and kept free of weeds.

Removal of Unsuitable Material

305 The Contractor shall remove unsuitable material as ordered or agreed by the Engineer and shall dispose of it on or off the Site as directed.

Excavation-General

306 (1) Excavation shall be carried out to the lines, levels and profiles shown on the Drawings or to such other lines, levels and profiles as the Engineer may direct or approve in writing. The work shall be carried out by the Contractor in such a way as to minimise disturbance to the surrounding ground. Particular care shall be taken to maintain stability when excavating in close proximity to existing works.

(2) The work shall be carried out in a careful manner to ensure that the exposed surfaces are as sound as the nature of the material permits and that no point shall protrude inside the lines shown on the Drawings except as otherwise specified or agreed by

the Engineer. In soft excavation which is to remain open permanently, exposed faces shall be formed accurately to the required slopes and profiles.

(3) The Contractor shall dispose of all material arising from excavations either on or off the Site as directed by the Engineer.

(4) The Contractor shall be responsible for keeping all excavations free from water from whatever cause arising and shall provide such pumping capacity and all other measures as may be necessary for this purpose.

(5) The Contractor shall properly support the sides of excavations and shall be responsible for their safety.

(6) The Contractor shall notify the Engineer without delay any unusual ground encountered during excavation.

Excavation Beyond True Lines and Levels

307 If from any cause whatsoever excavations are carried out beyond their true line and level other than on the instructions of the Engineer, the Contractor shall make good to the required line and level with the appropriate grade of filling to be contained in the true excavation, or with concrete or other approved material in such a manner as the Engineer may direct.

Approval of Excavation

308 (1) When excavations have been taken out accurately to the profiles or dimensions required for the work, the Contractor shall inform the Engineer so that he may carry out an inspection.

If, after his inspection, the Engineer requires additional excavation to be carried out, the Contractor shall do so to such new profiles or dimensions as the Engineer may direct.

(2) The Contractor shall obtain approval of excavations prior to placing fill or concrete. The Contractor shall maintain open excavations in an approved condition, and shall rectify the effects of deterioration due to weather.

Excavations for Structures

309 (1) Open excavation to form a foundation for a structure shall be carried out to the lines necessary to permit the proper construction of the structure to the approval of the Engineer.

(2) Where a structure is to be founded on soft ground, the excavation shall be taken down until the required formation is exposed and prepared to the approval of the Engineer.

(3) If required, before any concrete for a foundation is placed, the bottom of the excavation shall be re-compacted to achieve at least 98 % of the maximum dry density determined in accordance with Tests Nos. 12 and 15B of BS 1377.

(4) Surfaces of excavations or filling which are to receive reinforced concrete work shall, where indicated, be prepared with a blinding layer of concrete as shown on the Drawings or in such other manner as will provide a suitable surface at the correct lines and levels to the satisfaction of the Engineer.

Fill - General

310 Prior to commencement of filling to be placed in the dry (as opposed to hydraulic fill) the Contractor shall submit in writing to the Engineer for approval his proposals for carrying out the work such that the optimum use may be made of excavated material. The proposals shall include the compaction plant and methods for adjusting the moisture content of the material. Filling shall not commence until the proposals and the material intended to be used are approved by the Engineer. Requirements for hydraulically placed fill are given in Part 4 of the Specification.

Fill Material

311 Fill material shall be free of all organic and undesirable matter and be approved by the Engineer.

Compaction of Fill

312 (1) Approved fill material placed in the dry shall be compacted in layers of 250 mm maximum thickness to achieve a density of at least 95 % of the maximum dry density determined in accordance with Tests Nos. 12 and 15B of BS 1377.

(2) The 250 mm layer of fill material placed under the revetment crest wall and as access road sub-base shall be compacted to achieve a density of at least 98 % of the maximum dry density determined in accordance with Tests Nos. 12 and 15B of BS 1377.

Backfill to Structures

313 The Contractor shall not backfill around structures until the structural elements have attained adequate strength and the approval of the Engineer to proceed has been obtained. Unless otherwise directed,

the backfill material shall be selected excavated material, thoroughly compacted in layers not exceeding 250 mm deep to achieve a density of at least 95 % of the maximum dry density as determined in accordance with Tests Nos. 12 and 15B of BS 1377.

Placing of Fill

314 Before placing suitable fill, the ground surface shall be scarified to a depth of 200 mm, wetted to close cracks, and compacted to obtain a dry density not less than 95 % of the maximum dry density as determined by Test No. 12 of BS 1377. The fill shall be placed in layers not exceeding 250 mm compacted thickness.

The fill material prior to compaction shall be brought to a moisture content within the range $\pm$ 2% of the optimum as determined by Test No. 12 of BS 1377. Watering will be carried out in such a manner as to ensure the even distribution of water throughout the layer to be compacted and the compaction operations will follow whilst the moisture content remains within the specified range.

Testing of Fill

315 Classification tests shall be carried out to ensure that true comparisons can be made between insitu densities, laboratory compaction densities and field trial densities i.e. that variations in properties of materials being used in the tests are not affecting the results.

The relationship between the dry density and the moisture content of the fill shall be determined in accordance with Test No. 12 of BS 1377.

Tests shall be carried out on fill to determine the degree of compaction achieved, at the rate of one test for each 1000 m^2 of each fill layer or as otherwise directed, at locations ordered by the Engineer. Compacted layers shall not be covered without approval. The density of individual compacted layers shall be determined by the method detailed in Test No. 15B of BS 1377.

The insitu dry density of fill shall average 95 % of the maximum reached in Test No. 12 of BS 1377. No single result shall be less than 92 % and no more than 25 % of the results on any one layer shall fall between 92 % and 95 %. The average shall be computed from the total number of tests on any one layer where the extent of the layer is defined by the Contractor in submitting the same for inspection.

Slopes and Batters

316 Where a slope is given in the Specification or on the Drawings as a ratio of vertical and horizontal components, it shall be understood that the first component is vertical in all cases e.g. a "slope of 1 in 2" will mean 1 vertical in 2 horizontal and a "batter of 4 to 1" will mean 4 vertical to 1 horizontal. This meaning will be attributed to all other terms such as "inclination" and "gradient".

Topsoiling

317 The Contractor shall obtain topsoil from temporary dumps and shall spread it on level or sloping surfaces as directed by the Engineer.

Borrow Pits

318 Where fill is to be obtained from borrow pits, the Contractor shall first obtain approval of his proposed method of working from the Engineer. The Contractor shall ensure that borrow pits do not constitute a health hazard during the construction period, and that they are left on completion in a safe and suitable condition for subsequent use by farmers.

SPECIFICATION

PART 4 - DREDGING AND RECLAMATION

4A DREDGING

Definition

401 Dredging is defined as excavation below LWL + 2.00 m irrespective of the method employed.

General

402 Dredging will be required in order to form the profile on which the slope protection and "falling apron" will be constructed. The dredging spoil will be used as fill for revetment construction for land reclamation and for the formation of the access road embankments and cross-bars. The dredging spoil so placed will become part of the Permanent Works.

The Contractor may opt to use spoil from the dredging to form protective bunds in order to screen off all or part of the Works from the main river flow. Any dredging spoil so placed will be Temporary works.

Stockpiles

403 Where directed by the Engineer the Contractor shall place surplus dredging spoil in stockpiles. Such work shall be undertaken generally in accordance with Clause 417 of the specification.

Surveys and Soundings

404 (1) Before the commencement of dredging the whole area to be dredged,together with any adjacent areas whose level might be affected by the dredging, is to be surveyed and sounded and contour plans and sections are to be drawn accordingly. The survey work is to carried out by Contractor in the presence of the Engineer in accordance with methods proposed by the Contractor and approved by the Engineer. The plans and sections shall, when finally and mutually agreed, be signed by the Engineer and Contractor as truly representing the configuration of the area at the commencement of dredging and shall constitute the commencing surface for measurement.

(2) Before the Engineer accepts that the dredging has been completed the Contractor shall demonstrate, by means of soundings, surveys and sweeps by bar, or other mechanical methods, as approved by the Engineer, that the work has been executed to the required lines, levels and stable slopes. Such soundings, surveys and sweeps shall be carried out in the presence of the Engineer. Where areas are shown not to have been dredged to the required lines, levels and stable slopes, the Contractor shall return and

remove all high spots and/or trim slopes to the satisfaction of the Engineer.

(3) The equipment and method proposed for the sweep survey shall be submitted to the Engineer for approval and before commencement of sweeping. The Contractor shall demonstrate to the Engineer's satisfaction, by means of trials, the suitability of the equipment and methods proposed.

(4) Dredging works shall be executed in sections to suit the construction of the revetment. At the conclusion of each section of dredging, the Contractor shall inform the Engineer that the section is ready for examination with a view to its acceptance.

(5) Following completion of each section of dredging, and immediately prior to the placing of revetment filter and armouring, a final survey shall be undertaken in accordance with paragraph (2) of this Clause. The appropriate plans and sections shall be prepared and, after due agreement and signature by the Engineer and the Contractor, be deemed to represent the final configuration of the dredging of the specified area.

(6) The Engineer may order levels and soundings to be taken at any time as necessary for the proper supervision and measurement of the work. The existing levels of the areas to be dredged shown on the Drawings are for the purpose of guidance and assistance in estimating and shall be considered as indicative only.

(7) Soundings shall be taken on a 10 m square grid or at such other interval as may be agreed by the Engineer.

All soundings shall be carried out by means of a recording trace echo-sounder with sufficient sensitivity to permit accurate measurement of the river bed levels. The trace produced by the echo-sounder shall be spot checked at random by sounding line or by other methods approved by the Engineer. Such additional equipment as may be necessary shall be employed for the accurate checking of the revetment slopes.

Bed Formation/ Tolerances

405 (1) The Contractor shall execute the dredging within the plan limits indicated on the Drawings or otherwise directed by the Engineer and ensure that the

finished dredged work shall, at the time of acceptance, lie within the tolerance stated in Appendix A.

(2) If overdredging in excess of the limits specified in Appendix A should occur, the Contractor shall at his own expense fill the void up to such limits with filling material as directed and approved by the Engineer. Any such filling required in the dredged areas as result of over dredging shall be provided at the Contractor's expense.

(3) Throughout the duration of the Contract the Contractor shall be responsible for removing any siltation of dredged areas prior to the placing of the revetment filter and armouring.

Side Slopes

406 The Contractor shall, until completion of all the protection works at any location or any part thereof, be solely responsible for the stability of any permanent or temporary slope.

Temporary slopes shall be dredged and trimmed to stable slopes taking into account the natural slopes of the material. The Contractor shall comply with all instructions given by the Engineer for the purpose of determining such stable slopes.

On no account shall the Contractor dredge into the profile of the revetment.

Underwater Obstructions

407 At locations where river bank protection works have been carried out previously, the Contractor may encounter obstructions underwater such as concrete blocks, porcupines and miscellaneous other material. The Contractor shall provide the necessary equipment to remove such obstructions from the site of the Permanent Works.

Discharge into River

408 The Contractor shall take such measures as may be practicable to minimise turbidity arising at the point of dredging. Sediment concentrations shall be monitored as directed by the Engineer. Disposal of any surplus dredged spoil into the Brahmaputra River may be undertaken only after approval by the Engineer of a written plan submitted by the Contractor beforehand. Such plan shall state clearly the precautions to be taken to avoid interference with navigation, nuisance to established fishing areas, and influence on the morphological behaviour of the river.

Dredging Method Statement

409 Notwithstanding requirements for submission of a method statement as part of the tender, the Contractor shall, not less than 28 days prior to the commencement of dredging, submit a detailed statement of his proposed working methods to the Engineer for approval. The method statement shall include:

(a) the numbers, types and performance details of the equipment proposed,

(b) lengths of floating pipelines proposed,

(c) survey and position fixing systems to be used,

(d) method(s) of removing underwater obstructions,

(e) working method and sequence of dredging and filling operations.

Approval by the Engineer of the Contractor's method statement shall not relieve the Contractor of his obligation to construct the Works in accordance with the Contract.

Breakdowns

410 Plant breakdowns and any accidents shall be notified immediately to the Engineer.

Records of Operations

411 The Contractor shall make and keep records of all operations including the location of such operations, materials encountered, samples, the time of working, loading curves, performance of the Contractor's plant and equipment and overall progress of the Works. The records, in a form approved by the Engineer, shall be submitted by the Contractor to the Engineer daily and such information shall be summarised and submitted in weekly reports.

Compliance with Regulations

412 Persuant to Clause 26.1, the Contractor shall take due cognisance of the following Act and Ordinances.

The Environmental Pollution Act
The Marine Pollution Ordinance
The Inland Shipping Ordinance

Further, the Contractor will, under regulations yet to be enacted, be required, before commencement of dredging, to submit samples of the river bed for testing at a laboratory established for

that purpose. Proposals for disposal of dredging spoil will be subject to the approval of the laboratory staff on the basis of the test results.

4B RECLAMATION

Initial Surveys

413 Prior to commencement of filling the Contractor shall, in the presence of the Engineer, carry out the following surveys:

- the area to be filled and the natural drainage paths from any existing outfalls shall be surveyed on a grid of 10 m maximum spacing.
- a sounding survey of the existing river bed levels where filling is to take place. Sounding surveys shall be carried out generally in accordance with Clause 404 of the Specification.

Intermediate Surveys

414 The Contractor shall carry out all intermediate surveys for the purposes of establishing the value of works executed at the end of each month

Final Surveys

415 On substantial completion of filling the Contractor shall carry out surveys to demonstrate such completion having first given 7 days notice to the Engineer so that he may arrange to be present.

Acceptable Material for Reclamation

416 Reclamation and fill material shall be granular, non-cohesive naturally occurring, and shall be free from organic or deleterious material. Material gradings shall be as specified below:

Material Class B

Grading Curve

Percentage passing	Sieve size (mm)
0-10	0.063
100	200.0

Filling in Reclamation Areas

417 (1) Not less than 28 days prior to the commencement of the work concerned, the Contractor shall provide, for approval by the Engineer, statements and drawings giving in detail the proposed methods for carrying out the work which shall include the layout and construction of bunds and intermediate bunds required to retain the dredged material, methods of working within bunded areas to achieve the specified requirements, routes of pipelines for

deposition of fill, the design position/series of weir/water boxes, spillways and sequences of filling to allow uninterrupted and controlled passage of waste water, and methods for disposing of unsuitable material off site.

(2) Suitable material shall be placed hydraulically in the reclamation areas to the lines and levels as shown on the Drawings unless otherwise directed by the Engineer. The material shall be allowed to obtain its natural density. Vegetation and debris shall be cleared from the areas prior to deposition of fill.

(3) The Conractor shall carry out operations in filling and discharge of water from the fill area without disturbance to existing works and structures. Pipelines required for deposition of fill material shall be laid along routes and corridors approved by the Engineer. Any road or river crossings of pipelines shall be construced so as to minimise interference with traffic both during construction and operation of pipelines.

The Contractor shall take measures to prevent unacceptable leakage from pipe joints and shall deal with leakage that does occur in a manner approved by the Engineer.

(4) The material shall be discharged at such points over the fill area as to optimise the homogeneity of filling to the approval of the Engineer.

The Contractor shall take measures to avoid producing pockets of silt in the reclamation. If pockets of silt occur and cumulative depth in any one core taken in accordance with this specification exceeds 150mm then the Contractor shall remove the silt and replace it with suitable material. Silt means material passing 0.063mm sieve.

Final reclamation levels shall be as shown on the Drawings subject to permited tolerances of -0, + 200 mm.

(5) Testing shall be carried out by the Contractor in the reclamation fill to determine whether or not the material placed conforms with the requirements of the Specification. The results shall be in a form and give such information as the Engineer may direct.

Unless directed otherwise by the Engineer, sampling shall be carried out as follows:

(a) Bag samples (large) (25kg)

Every day during the progress of filling, the Contractor shall take two bag samples of the material placed in reclamation at locations directed by the Engineer. Samples shall be taken at a maximum depth of 0.5 m.

(b) On completion of filling, the Contractor shall take further samples of the materials placed in the reclamation by means of cable percussion boreholes. The boreholes shall be at 50 metre intervals and shall exend through the full depth of the fill material. The locations and depths of the boreholes shall be as directed by the Engineer. Samples shall be taken at 1 metre intervals, starting at depth 0.5 m.

The Contractor shall carry out all of the following tests on each of the bag samples and the borehole samples:

(i) wet sieve analysis, Test 7A of BS1377

(ii) particle size distribuion by hydrometer, Test 7D of BS1377

(iii) specific gravity, Test 6 of BS1377 (density bottle or pycnometer)

(iv) bulk density to BS1377

Where directed by the Engineer, samples shall be tested for toxic content.

Unsuitable Material

418 (1) Material, which has been deposited in reclamation areas and, in the opinion of the Engineer, does not comply with the specified requirements for filling, shall be removed by the Contractor from Site and replaced with suitable fill. Such removal and replacement shall be a the Conractor's expense.

(2) If material is deemed unsuitable it shall be disposed of at the Contractor's expense off Site at either:

606

- a dumping area between the river banks subject to the approval of the Engineer and any statutary controlling bodies and organisations concerned,

or

- an approved dumping site on land for which the Contractor shall obtain all necessary permissions.

Prior to the commencement of reclamation the Contractor shall specify in writing to the Engineer his proposed disposal areas. The Contractor shall obtain all necessary licenses, consents etc for dumping operations and pay all appropriate fees, dues, royalities etc.

SPECIFICATION

PART 5 - CONCRETE

General

501 (1) The Contractor shall supply at Site all labour, tools, concrete mixers, batching plant, cement, fine aggregates, coarse aggregates, water, formwork and any other materials and equipment required for concreting. All operations shall be supervised by trained staff.

(2) All sampling and testing of constituent materials shall be carried out in accordance with the provisions of the appropriate British Standard or ASTM Standard. All sampling and testing of fresh and hardened concrete shall be carried out in accordance with the provisions of BS 1881.

Cement

502 (1) The cement used in the Works shall be Ordinary Portland Cement complying with BS12.

(2) The Contractor shall provide from each consignment of cement, delivered to the Site, such samples as the Engineer may require for testing. Each consignment of cement delivered to the Site shall be accompanied by a certificate showing the place of manufacture and the results of standard tests carried out on the bulk supply from which the cement was extracted.

(3) In addition to the tests described above, the Engineer may also make any further tests which he may consider advisable or necessary to ascertain if the cement has deteriorated in any manner during transit or storage. Cement showing lumps which cannot be broken to original fineness by finger pressure will be rejected irrespective of age and shall be removed from the Site.

(4) The cement shall be delivered to the Site of the Works in sound and properly sealed bags or bulk containers and while being loaded or unloaded and during transit to the concrete mixers, whether conveyed in vehicles or by mechanical means, shall be protected from the weather by tarpaulins or other approved coverings.

(5) Any cement which in the opinion of the Engineer is of doubtful quality shall not be used in the Works until it has been re-tested and test result sheets, showing that it complies in all respects with

the relevant standard, have been delivered to the Engineer.

Storage of Cement

503 The Contractor shall provide waterproof and well-ventilated sheds or godowns at the specified or approved location at Site, having a floor of wood or concrete raised at least 450 mm above the ground. The sheds shall be large enough to store sufficient cement to ensure continuity of work and each consignment must be stacked separately therein to permit easy access for inspection. The cement shall be placed in the sheds immediately upon delivery to the Site and shall be used in the order in which it has been delivered. Cement delivered to the Site in drums or bags provided by the supplier or manufacturer shall be stored in the drums or bags until used in the Works. Any cement in drums or bags which have been opened shall be used immediately after opening.

Aggregates - General

504 (1) Stone aggregates shall comply with B.S. 882: Part 2 and shall be hard, strong, durable, dense and free from injurious amounts of adherent coatings, clay, lumps, dust, soft or flaky particles, shell, mica, alkali, organic matter and other deleterious substances.

(2) The various sizes of particles of which an aggregate is composed shall be uniformly distributed throughout the mass.

(3) The aggregates shall be stored on hard and dry ground sealed with a layer of lean concrete 50 mm thick, with adequate partitions to ensure the separation of different types and gradings. Care shall be taken in storage to avoid inclusion of any foreign material in the aggregates. The aggregates shall be handled so as to avoid segregation of various sizes within each grade.

(4) Testing of aggregates shall be in accordance with B.S. 812.

(5) Approval of a source of aggregate by the Engineer shall not be construed as constituting the approval of all materials to be taken from that source and the Contractor shall be responsible for the specified quantity of all such materials used in the Works. The Contractor shall not obtain aggregates from sources which have not been approved by the Engineer.

Coarse Aggregate

505 (1) The coarse aggregates shall consist of natural or crushed stone or gravel unless brick chips

aggregate is accepted for use in precast concrete cubic blocks for revetment armouring.

(2) The pieces of aggregate shall be well shaped, angular or, except for concrete surfaces subject to abrasion, rounded in shape and have granular or crystalline or smooth, but not glossy non-powdery, surfaces.

(3) The amount of clay, fine silt and fine dust occurring in a free state or as a loose adherent shall not exceed one percent by weight. The sum of the percentages of all deleterious substances in any size shall not exceed three percent by weight. After 24 hours immersion in water, the previously dried sample shall not have gained in weight more that five percent for use in reinforced concrete and not more than ten percent for use in plain concrete. The specific gravity of stone or gravel aggregate shall not be less than 2.6.

(4) Coarse aggregates shall be well graded within gradings given in Table 505 and to the satisfaction of the Engineer.

Table 505
Percentage by Weight Passing Standard Sieves

BS 410 Standard mesh (mm)	10 mm to 5 mm	20 mm to 5 mm	40 mm to 5 mm
75.0	-	-	100
37.5	-	100	95-100
20.0	100	95-100	35- 70
10.0	85-100	30- 60	10- 40
5.0	0- 25	0- 10	0- 5

(5) Brick ballast or broken Jhama chips, used for precast concrete cubic blocks, shall be broken to the required gradings from first class bricks or their bats, or from dense overburnt bricks, all as specified below. The Contractor shall confine the procurement of bricks to kilns using coal for fuel. Prior to making arrangements for the purchase of bricks he shall provide for the Engineer's approval a list of kilns he proposes to use.

Bricks for concrete coarse aggregate shall be broken first class bricks or so-called "picked

Jhama" bricks. Picked Jhama bricks shall be over-burnt first class bricks, uniformly textured, with good shape, slightly black in colour and without cracks and spongy areas. Otherwise picked Jhama bricks shall meet the same specification as first class bricks.

First class bricks shall comply with the following:

(i) Sound, hard and well burnt, uniform in size, shape and colour, homogeneous in texture and free from flaws and cracks. A fractured surface shall show a uniform compact structure, free from holes, lumps or grit.

(ii) Minimum crushing strength 15 N/mm^3

(iii) Maximum water absorption: increase in weight after absorption in water for one hour shall not be more than 16 percent.

(iv) Dimensions: 240 mm x 120 mm x 70 mm (all dimensions plus or minus 5 mm).

(6) The Contractor shall provide means of storing the aggregates at each point where concrete is made such that

(i) each nominal size of coarse aggregate and the fine aggregate shall be kept separated at all times;

(ii) contamination of the aggregates by the ground or other foreign materials shall be effectively prevented at all times; and

(iii) each heap of aggregate shall be capable of draining freely. The Contractor shall ensure that graded coarse aggregates are tipped, stored and removed from store in a manner that does not cause segregation.

(7) The Contractor shall make available to the Engineer such samples of the aggregate as he may require. Such samples shall be collected at the point of discharge of aggregate to the batching plant or mixing machines. If any such sample does not conform to the Specification, the aggregate shall promptly be removed from the site and the Contractor shall carry out such modifications to the storage arrangements as may be necessary to secure compliance with the Specification.

Fine Aggregates

506 (1) Fine aggregates shall be non-saline and consist of hard, dense, durable materials and shall be free from injurious amounts of clay lumps, light - weight materials or other deleterious substances.

(2) Fine aggregates shall have specific gravity not less than 2.6 and a fineness modulus value between 2.5 to 3.0 for concrete Class A1 and A2 concrete and greater than 1.5 for Class B concrete and greater than 1.0 for Class C1 and C2 concrete.

(3) The grading of the fine aggregate shall lie within one of the grading zones as set out in Table 506 below and specified in BS 882.

Table 506

Percentage by Weight Passing Standard Sieves

BS Standard mesh	Grading Zone 1	Grading Zone 2	Grading Zone 3	Grading Zone 4
10.00 mm	100	100	100	100
5.00 mm	0-100	90-100	90-100	95-100
2.36 mm	60-95	75-100	85-100	95-100
1.18 mm	30-70	55-90	75-100	90-100
600 um	15-34	35-59	60-79	80-100
300 um	5-20	8-30	12-40	15-50
150 um	0-10	0-10	0-10	0-15

If the individual percent retained on 1.18 mm sieve is twenty percent or less, the maximum limit for the individual percent retained on the 2.36 mm sieve may be increased to twenty percent.

Water

507 Water to be used in concrete, mortar and grout shall where possible be fit for drinking purposes and shall be taken from an approved source. It shall be free from objectionable quantities of silt, organic matter, alkali, salt and other impurities. Whenever required to do so by the Engineer

the Contractor shall take samples of the water being used or which is proposed to be used for mixing concrete and test them in accordance with BS 3148. No concrete shall be made with unapproved water.

Admixtures

508 (1) Admixtures shall mean materials added to the concrete materials during mixing for the purpose of altering the properties of the concrete mix.

(2) If the Contractor wishes to use admixtures, other than as expressly ordered by the Engineer, he shall first obtain the Engineer's written permission. The methods of use and the quantities of admixture used shall be subject to the Engineer's approval, which approval or otherwise shall in no way limit the Contractor's obligations under the Contract to produce concrete with the specified strength and workability.

Steel for Reinforced Concrete

509 (1) Steel reinforcement, other than steel for prestressing, used in reinforced concrete shall comply with the following British Standards as appropriate:-

B.S. 4449 "Hot rolled steel bars for the reinforcement of concrete".

B.S. 4461 "Cold worked steel bars for the reinforcement of concrete".

B.S. 4482 "Cold reduced steel wire for the reinforcement of concrete".

B.S. 4483 "Steel fabric for the reinforcement of concrete".

Deformed bars of high tensile steel may be used if approved by the Engineer or shown on the Drawings.

(2) The Contractor shall furnish the Engineer with copies of the manufacturer's certificates of tests for the steel reinforcement to be supplied. The Engineer may, however, order independent tests to be made and any steel which does not comply in all respects with the appropriate foregoing specifications will be rejected.

(3) Bends, cranks or other labours on reinforcement bars shall be carefully formed in accordance with the Drawings, B.S. 4486 "Bending dimensions and scheduling of reinforcement for concrete" and BS 8110 "Structural use of concrete". The bars shall be bent cold in a manner which will not injure the material. Bending hot at cherry red heat (i.e. not exceeding 1550^0 F) may be allowed except for bars which depend for their strength on cold working. Bars bent hot shall not be cooled by quenching. Bends shall be made round a former having a diameter of at least four times the diameter of the bar except for bends in cold twisted steel bars and deformed bars of high tensile steel for which a former of at least six times the diameter of the bar shall be used. Where splices or overlapping in reinforcement are required the bars shall, unless otherwise shown on the Drawings, have an overlap of not less than thirty diameters where a U-hook is employed on each of the overlapping bars and forty-five diameters for bars without hooks.

Fabric reinforcement sheets are to overlap by two meshes.

(4) The number, size, form and position of all steel reinforcing bars, ties, links, stirrups and other parts of the reinforcement shall be in exact accordance with the Drawings and they shall be kept in the correct position and with the required cover without displacement during the process of compacting the concrete in place in a manner approved by the Engineer. The Contractor shall provide all necessary distance pieces and spacer bars at his own cost to maintain the reinforcement in the correct position. The type of distance pieces shall be subject to the approval of the Engineer. Timber blocks for wedging the steel off the formwork will not be allowed. Any ties, links or stirrups connecting the bars shall be taut so that the bars are properly braced and the inside of hooks and bends shall be in actual contact with the bars around which they are intended to fit. Bars shall be bound together with best black annealed mild steel wire and the binding shall be twisted tight with pliers. The free ends of binding wire shall be bent inwards.

(5) Before any steel reinforcement is embedded in the concrete any loose mill scale, loose rust and any oil, grease or other deleterious matter shall be removed. Partially set concrete which may adhere to the exposed bars during concreting operations shall

likewise be removed.

(6) The Contractor will be provided by the Engineer with bending schedules detailing the reinforcement required for the Permanent Works. The provision of the schedules shall not relieve the Contractor from his responsibilities under the Contract for providing the materials called for on the Drawings. All further working drawings and lists of reinforcement necessary to carry out the Works shall be provided by the Contractor at his own cost.

Classes of Concrete

510 (1) Classes of concrete containing Ordinary Portland Cement and specified coarse and fine aggregates shall be as shown in Table 510 below.

Table 510

Classes of Concrete

Concrete Criteria	Class A1	Class A2	Class B	Class C1	Class C2
Nominal Maximum Aggregate Size (mm)	40	20	40	40	20
Trial mix strength (cylinder) (N/mm^2)	19.0	19.0	15.0	6.0	6.0
Minimum cement content of concrete (kg/m3)	290	330	245	N/A	N/A
Maximum cement content of concrete (kg/m3)	400	400	350	N/A	N/A
Maximum free water to cement ratio by weight	0.52	0.52	0.55	0.60	0.6

N/A = not applicable.

To obtain the equivalent trial mix strength for 150 mm concrete test cubes, divide the cylinder strength by 0.85

(2) Proportions shall be determined by trial mixes.

(3) The minimum cement content of Class B concrete may be increased by the Engineer at his discretion.

Design of Concrete Mixes

511 At least two months prior to the commencement of concreting operations, the Contractor shall design a mix for each class of concrete listed in Table 509 and shall submit full details of the mix designs to the Engineer for his approval. Each mix design shall be such that:

(1) The aggregate shall comprise fine aggregate as specified in Clause 506 and coarse aggregate of the maximum size specified in Clause 505. The combined aggregate grading shall be continuous. Aggregate proportions shall be calculated by weight.

(2) The mixes shall be designed to produce an average concrete cylinder strength at twenty-eight days after manufacture not less than the trial mix test strength specified in Table 510. For concrete using other than Ordinary Portland Cement or incorporating admixtures, the strengths shall not be less than those specified in Table 510 but the mix designs shall be revised and agreed with the Engineer.

Workability

512 The workability of each class of concrete shall be such that satisfactory compaction can be obtained when the concrete is placed and vibrated in the Works and that there is no tendency to segregate when it is handled, transported and compacted by the methods which the Contractor proposes to use when handling, transporting and compacting that class of concrete in the Works. The consistency or workability of the concrete shall be determined and tested by the slump test in accordance with BS 1881 and the results to be obtained shall depend on the concrete mix, the method of placing, the method of compaction, and the location of the concrete, etc. The following table is given as a guide to the range of slumps which may be appropriate depending upon the workability required. The requirements as stated in Clause 514 Sub-Clause (2) and (4) of hereof shall remain valid also.

Type of concrete	Slump
All classes of concrete	50 to 100 mm

Preliminary Mixes

513 (1) The proportions of cement, aggregate and water determined by the Contractor in his mix design shall be used in preliminary mixes of concrete made and tested for strength and workability under laboratory conditions. These preliminary mixes shall be repeated with adjusted proportions as necessary until concrete mixes meeting the requirement of the preliminary and trial mix tests in Table 510 and with the workability defined in Clauses 512 and 514 have been produced.

(2) If at any time during construction of the works, the sources of cement or aggregates is changed, or the grading of the aggregate alters then further preliminary mixes shall be undertaken.

Trial Mixes of Concrete

514 (1) As soon as the Engineer has approved the concrete mix design for each class of concrete during or following the carrying out of the preliminary tests the Contractor shall prepare a trial mix of each class in the presence of the Engineer. The trial mixes shall be mixed for the same time and handled by means of the same plant which the Contractor proposes to use in the Works. Each mix shall comprise not less than one-half a cubic metre of concrete. The proportion of cement, aggregates and water, shall be carefully determined by weight in accordance with the Contractor's approved mix design (or modified mix design after preliminary tests), and sieve analyses shall be made of the fine aggregate and each nominal size of coarse aggregate used.

(2) The slump of each batch of trial mix shall be determined immediately after mixing by the method described in B.S. 1881 and shall not be outside the limits set in Clause 512.

(3) Cylinders as compression test specimens shall be made by the Contractor in the presence of the Engineer from each trial mix. The concrete samples shall be made, cured, stored and tested at twenty eight days after manufacture. If the average value of the ultimate compressive strength of the six samples taken from any trial mix is less than the trial mix test strength given in Table 510 the Contractor shall redesign that mix and make a further preliminary mix, trial mix and sets of test cylinders.

(4) A full scale test of the workability of each trial mix of each class of concrete shall be made by the Contractor in the presence of the Engineer. The trial mix of each class of concrete shall be batched

mixed and then transported to a representative distance in the manner that the Contractor proposes to batch, mix and transport the concrete to be placed in the Works. After discarding the first batch so made, the concrete from later batches shall be placed and compacted in trial moulds both for reinforced and mass concrete with dimensions typical of the Works in accordance with the procedures described in subsequent clauses herein, the sides of the moulds being capable of being stripped without undue disturbance of the concrete placed therein. The sides of the moulds shall be stripped immediately after placing the concrete and the workability judged on the compaction obtained. If the workability test shows that the workability required is not attained for any trial mix for any class of concrete, the trial mix shall be redesigned by the Contractor and a further full scale workability test shall be undertaken for that trial mix of concrete. The redesign of the concrete mixes and the making and testing of preliminary and trial mixes of concrete shall be repeated for each class of concrete until trial mixes of concrete meeting the requirements of Clauses 510 and 512 and having the workability required to place it in the works as demonstrated in the full scale workability test described above have been established.

(5) The Contractor shall only use the approved mix of each class of concrete in the Works. If at any time during the construction of the Works, the source of cement or aggregate is changed or the grading of the aggregate retained on any sieve cannot be maintained within two percent of the total quantity of fine and course aggregate when adjusted in accordance with Clause 518 then further preliminary tests shall be carried out and further trial mixes of concrete shall be made, tested, and approved for use.

(6) The Contractor is fully responsible for designing the mixes in such a way that concrete of the required specification is used in every part of the Works. The mix design shall be thoroughly tested as specified until a satisfactory mix is obtained and approved by the Engineer. Such approval in no way relieves the Contractor of his responsibility for placing the concrete of required specifications in the Works. No change in mix proportions will be made without Engineer's consent.

Limitation of Water/ Cement Ratio

515 (1) No concrete shall have a water/cement ratio weight in excess of the values shown on Table 510.

(2) In designing and establishing approved mixes of concrete for any part of the Works the Contractor shall take account of any other limitations on water/cement ratios which may be shown on the Drawings or expressly stated elsewhere as applying to concrete for particular parts of the Works.

(3) Throughout concrete production the actual water/cement ratio shall be strictly monitored and the batch quantities of aggregates and water regularly adjusted to maintain the design water/cement ratio.

Weighing or Measuring Materials for Concrete

516 (1) All cement used in the manufacture of concrete shall be measured by weight either with an approved weighing machine or by making the size of each batch of concrete such as to require an integral number of complete bags or drums of cement.

(2) For Class A1, A2 and B concrete, the fine and coarse aggregates shall be measured singly or cumulatively by weight using weigh-batching machines.

(3) Weigh-batching machines shall provide facilities for the accurate control and measurement of the materials either singly or cumulatively and shall be capable of immediate adjustment by semi-skilled operators in order to permit variations to be made to the mix. All weigh dials shall be easily visible from the place at which filling and emptying of the hoppers is controlled.

(4) Every concrete-mixing machine shall be fitted with a water measuring device which shall be so constructed that the inlet and outlet valves are inter-locked so that either one of them can not be opened unless the other is fully closed. The device shall be provided with an overflow with a cross-sectional area at least four times that of the outlet pipe and with its discharge point clear of the mixing plant. The entire water system shall be maintained free of leaks at all times and the measuring device shall be fitted with a drain pipe which allows the full quantity of water being measured to be drained off for checking the measurement. The outlet arrangements of the measuring device shall be such that between five and ten percent of the water enter the mixer before the other materials and further five to ten percent of the water enters the mix after the other materials. The remainder of the water shall be added at a uniform rate with the other materials. The water measuring device shall also be readily adjustable so that the quantity of water added to the

mixer can, if necessary, be varied for each batch.

(5) Any admixture which may be used shall be measured separately in calibrated dispensers and shall be added to the mixture with the water.

(6) All mixing and batching plants shall be maintained free of set concrete or cement and shall be cleaned before commencing mixing. At such intervals as may be directed by the Engineer the Contractor shall provide weight containers and equipment necessary for testing the accuracy of the weighing plant, water measuring plant and admixture dispenser.

Mixing Concrete

517 (1) Concrete shall be mixed in batches in plant capable of combining the aggregates, cement and water (including admixtures, if any) into a mixture uniform in colour and consistency and of discharging the mixture without segregation.

(2) On commencing work with a clean mixture the first batch shall contain only half the normal quantity of coarse aggregate to compensate for the adhesion of the other materials to the drum. The natural moisture content of the aggregate shall be determined before the commencement of concreting each day and at other times as may be necessary. The Contractor shall make due allowance for the water contained in the aggregates when determining the quantity of water to be added to each mix, and shall adjust the amount of water added to each mix to maintain constant the approved water/cement ratio of the mixed concrete.

(3) The Contractor shall render to the Engineer, not more than twenty four hours in arrears, a daily return for each class of concrete placed, the number of batches wasted or rejected and the weight of cement used.

Quality Control of Concrete

518 The Contractor shall be responsible for providing samples of concrete and its constituent materials both for testing by himself or for testing at the Engineer's laboratory. For this purpose concrete test cylinders which shall be made in accordance with BS 1881, shall be deemed to be 'samples'. All sampling of constituent materials shall be carried out in accordance with the provisions of the appropriate British Standard, and all sampling of fresh and of hardened concrete shall be carried out in accordance with the provisions of BS 1881.

The tests which the Contractor is required to undertake himself on behalf of the Engineer are those to be carried out on fresh concrete at the place of final deposit, or elsewhere on the Site as directed by the Engineer. These tests shall comprise:

(i) Sieve Analysis of Aggregates

The Contractor shall sample and carry out a mechanical analysis of the fine aggregate and each nominal size of coarse aggregate at least once in each week when concreting is in progress and at such more frequent intervals as the Engineer may require. The grading of all aggregates shall be within the respective limits specified in Clauses 505 and 506 and should the fraction of aggregate retained on any sieve differ from the corresponding fraction of aggregate in the approved mix by more than two percent of the total quantity of fine and coarse aggregate the Engineer may instruct the Contractor to alter the relative proportions of the aggregate in the mix to allow for such difference.

(ii) Adjustment to Water/Cement Ratio

The Contractor shall test aggregates for moisture content and so determine the water/cement ratio of the fresh concrete. Determinations of water/cement ratio shall be carried out as required by the Engineer and the results and calculations submitted to him.

(iii) Slump Tests

The Contractor shall undertake slump tests of the freshly made concrete. Slump tests shall be carried out on each batch of concrete or less frequently if directed by the Engineer.

(iv) Concrete Cylinders

The sampling of concrete for concrete cylinders shall, where possible, be undertaken at the place of deposition of the concrete in the structure. Each sampling shall provide sufficient concrete to make six cylinders and allow a slump test.

After stripping, each cylinder shall be indelibly marked with the date taken, location in the structure and prescribed number.

The frequency of sampling for each class of concrete from each batching centre in each active day shall be as set out below or direct by the Engineer:

(a) one sample from one batch of every 10 batches; or

(b) one sample per 10 cubic metres of concrete; or

(c) one sample

whichever involves the greatest number of samples.

(v) Coring

As and where directed by the Engineer cylindrical core specimens of 150 mm nominal diameter shall be cut perpendicular to the face of the hardened concrete in the Works for the purpose of examination and testing. The procedure for drilling examination measurement and testing for compressive strength shall be in accordance with ASTM Standard C42 or similar standard. Prior to preparation for testing, the specimen shall be made available for examination by the Engineer. If the crushing strength of the specimen determined in accordance with ASTM Standard C42 is less than the minimum crushing strength given in Table 510 or if, in the opinion of the Engineer, the concrete fails to meet the specified requirements in other respects, the concrete in that part of the Works of which it is a sample will be considered not to comply with the specified requirements.

Failure to Pass Tests

519 If the specified values are not obtained for cylinder tests on any concrete mix, no further concrete of that mix shall be placed in the Works and the Contractor shall establish the cause of the failure and supply such remedies as are necessary. The Contractor shall demonstrate by trial mixes and the results of cylinder tests that the revised mix is in accordance with the Specification.

Preparing for Concreting

520 (1) Before placing concrete the Contractor shall remove from the surface of the foundations or previously placed concrete all oil, earth, mud, timber and other debris, and standing water to the satisfaction of the Engineer.

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(2) Where specified and elsewhere as ordered by the Engineer, the excavated surfaces on which concrete is to be placed shall be covered with either blinding concrete not less than 100 mm thick, or water proof building paper, or polythene sheeting immediately after completion of the final trimming of the excavation.

Inspection by Engineer

521 No concrete shall be placed until the Engineer has inspected and approved the surfaces upon which the concrete is to be placed, the form work and the reinforcing steel in placed position.

Transporting Concrete

522 Concrete shall be conveyed from the mixer/batching plant to its place in the Works as rapidly as possible by methods which will prevent segregation or drying out and ensure that the concrete is of the required workability at the point and time of placing. If segregation has nevertheless occurred in any instance the materials shall be remixed.

Placing Concrete

523 (1) Concrete shall be placed and compacted before initial set has occurred and in any event not later than forty five minutes from the time of mixing.

(2) Concrete shall be carefully placed in horizontal layers. Concrete shall not be allowed to slide or flow down sloping surfaces directly into its final position and shall be placed in its final position from skips, trucks, buckets barrows, down pipes or other placing machine or device or, if this is impossible, it shall be shovelled into position, care being taken to avoid segregation of the constituent materials. Concrete placed in horizontal slabs from barrows or other tipping vehicles shall be tipped into the face of the previously placed concrete.

Compaction

524 (1) All concrete placed in situ shall be compacted with power driven internal type vibrators supplemented by hand spading and tamping. The vibrators shall at all times be adequate in numbers, amplitude and power to compact the concrete properly and quickly throughout the whole of the volume being compacted to the satisfaction of the Engineer. Spare vibrators shall be readily on hand in case of breakdown.

(2) Internal type vibrators shall be inserted into the uncompacted concrete vertically and at regular intervals. Where the uncompacted concrete is in a layer above freshly compacted concrete the

vibrator shall be allowed to penetrate vertically for, say, 50 mm into the previous layer. In no circumstances shall the vibrators be allowed to come into contact with the reinforcement or formwork nor shall they be withdrawn quickly from the mass of concrete but shall be drawn back slowly so as to leave no voids. Internal type vibrators shall not be placed in the concrete in a random or haphazard manner nor shall concrete be moved from one part of the work to another by means of the vibrators.

(3) The duration of vibration shall be limited to that required to produce satisfactory compaction without causing segregation. Vibration shall on no account be continued after water or excess grout has appeared on the surface.

Concrete Placed in Water

525 (1) Concrete shall only be placed in water with the Engineer's written permission and where in his opinion it is not practicable to place the concrete in the dry. The quantity of cement in any concrete placed in water shall, if necessary, be increased so that the water/cement ratio of the mix is not more than 0.47.

(2) Concrete shall not be placed in running water nor shall concrete be allowed to fall through water.

(3) Concrete shall only be placed in water with a bottom-opened water tight box or a tremie pipe of a type approved by the Engineer. Bottom-opening boxes shall not be opened until they are resting on the work, and the lower ends of tremie pipes shall always be kept below the surface of freshly placed concrete.

Concreting in Adverse Weather

526 No concreting will be allowed to take place in the open during storms or heavy rains. Where strong winds are likely to be experienced additional precautions to ensure protection from driving rain and dust shall also be taken.

The Engineer may withhold approval of commencement of concreting until he is satisfied that full and adequate arrangements have been made.

Concreting at Night or in the Dark

527 Where approval has been given to carry out concreting operations at night or in places where daylight is excluded, the Contractor is to provide adequate lighting at all points where mixing, transportation and placing of concrete are in

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progress.

Concreting in High Ambient Temperature

528 (1) Where the ambient shade temperature exceeds 32°C the Contractor shall take special measures in the mixing, placing and curing of concrete. The temperature of the concrete when deposited shall not exceed 30°C. The Contractor shall carry out all necessary special measures to ensure that the maximum concrete temperature after placing shall not exceed 50°C or 30°C above the concrete temperature at the time of placing, whichever is the lower.

Curing of Concrete

529 (1) Concrete shall be cured by protecting the surface from the effects of sunshine, dry winds, frost, rain, running water or mechanical damage for a continuous period of seven days or such period as may be directed by the Engineer. The protection shall be applied as soon as practicable after completion of placing by one or more of the following methods:

(i) by water spray in continuous operation;

(ii) by covering with hessian or similar absorbent material, or sand, kept constantly wet;

(iii) after thorough wetting, by covering with a layer of water proof fabric kept in contact with the concrete surface;

(iv) by application of an approved non-staining liquid curing membrane which is either self removing or easily removed following the curing period and which has a seventy five percent moisture retention standard. The liquid shall be applied to formed surfaces immediately after stripping the formwork.

Liquid curing membranes (iv) shall not be used on surfaces where laitance is removed and aggregate exposed to provide a satisfactory bond for placing further concrete or mortar creeds or on surfaces where the Engineer is of the opinion that the appearance of the concrete surface will be affected.

Concrete Formwork

530 (1) The Contractor shall submit for the approval of the Engineer details of the methods and materials proposed for formwork to each section of the work. Details of all proposed fairfaced formwork and formwork to produce special finishes are to be submitted for approval in writing, by the Engineer, before any materials are brought on to the Site. If the Engineer so requires, samples of formwork shall be

constructed and concrete placed so that the proposed methods and finish effect can be demonstrated.

(2) Formwork shall be constructed from sound materials of sufficient strength, properly braced, strutted and shored as to ensure rigidity throughout the placing and compacting of the concrete without visible deflection. Formwork shall be so constructed that it can be removed without shock or vibration to the concrete. No part of any metal tie or spacer remaining permanently embedded in the concrete shall be nearer than 50 mm to the finished surface and the cavity shall be so formed as to permit satisfactory filling with cement mortar.

(3) All joints shall be close fitting to prevent leakage of grout and at construction joints the formwork shall be tightly secured against previously cast or hardened concrete to prevent stepping or ridges to exposed surfaces.

(4) Formwork shall be constructed to provide the correct shape, lines and dimensions of the concrete shown on the Drawings. Due allowance shall be made for any deflection which will occur during the placing of concrete within the formwork. Panels shall have true edges to permit accurate alignment and provide a neat line with adjacent panels and at all construction joints. All panels shall be fixed with their joints either vertical or horizontal, unless otherwise specified or approved. Unless otherwise detailed, arrises of all concrete shall be finished to a 25 mm x 25 mm chamfer. When chamfers are to be formed, the fillets shall be accurately cut to size to provide a smooth and continuous chamfer.

Formwork for Exposed Concrete Surfaces

531 Unless otherwise stated in the Drawings, fairfaced formwork shall be used for all permanently visible concrete surfaces. Fairfaced formwork shall be such as to produce a smooth and even surface free from perceptible irregularities. Tongued and grooved planed boards, plywood or steel forms shall have their joints flush with the surface.

Where a surface is partly below and partly above the final ground level, the finish for the exposed surface shall extend for 0.15 m below the ground level.

The finished surface shall be within the tolerances specified and full cover to reinforcement steel shall be maintained.

Formwork for Non-Exposed Concrete Surfaces

532 Unless otherwise stated on the Drawings, and subject to Clause 531 above, rough formwork may be used for all surfaces which are not permanently exposed. Rough formwork may be constructed of plain butt-joined sawn timber but the Contractor shall ensure that all joints between boards shall be grout-tight. The finished surface shall be within the tolerances specified and full cover to reinforcement steel shall be maintained.

Preparation of Formwork for Concrete

533 (1) Before concrete is placed, the formwork shall be thoroughly cleaned and free from sawdust, shavings, dust or other debris. Temporary openings shall be provided to assist in removal of rubbish.

(2) After cleaning the formwork shall be coated with an approval release agent, which shall not be allowed to run on to reinforcement, other embedded steelwork or concrete at any construction joint.

(3) All formwork shall be inspected and approved by the Engineer before concrete is placed in it though this shall not relieve the Contractor from the requirements as to soundness, finish and tolerances of the concrete specified elsewhere.

Removal of Formwork

534 Formwork shall be removed in such a manner as will not damage the concrete. No formwork shall be removed until the concrete has gained sufficient strength to support itself. The following table is a guide to the minimum periods which must elapse between the completion of the concreting operations and the removal of formwork. No formwork shall be removed without the permission of the Engineer and such permission shall not relieve the Contractor of his responsibilities for the safety of the structure.

Minimum stripping and striking times shall be as follows unless otherwise approved by the Engineer, for Ordinary Portland Cement concrete in normal weather:

	Hours
Vertical surfaces	10
Vertical wall surface under 300 mm thick	30
Beam sides	30

Cover to Reinforcement

535 The concrete cover to reinforcement shall be in accordance with the relevant British Standard Code of Practice or as shown on the Drawings.

The Contractor shall provide any necessary cement pads or approved plastic spacers for ensuring that the cover is attained and in no case shall timber packing be used.

Concrete Surface Finish

536 (1) The Concrete surface finish on upward facing horizontal or sloping faces shall be, except for blinding concrete or otherwise stated on the drawings, a "fair" surface. A "fair" surface shall be obtained by screeding and trowelling with a wood float.

(2) Screeding shall be carried out, following compaction of the concrete, by the slicing and tamping action of a screed board running on the top edges of the formwork or screeding guides to give a dense concrete skin true to line and level.

(3) Wood float trowelling shall be carried out after the concrete has stiffened and the film moisture has disappeared. Working should be kept to the minimum compatible with a good finish and the surface shall be true to the required profile to fine tolerance. Whenever necessary the Contractor shall provide and erect overhead covers to prevent the finished surface from being marred by raindrops or dripping water.

(4) The surface of blinding concrete shall be that obtained by screeding as described above.

(5) Where a "fine" surface is indicated upon the Drawings this shall be obtained in a similar manner to "fair" surface save that a steel float shall be used in lieu of the wood float.

Finish and Finishing

537 (1) Surface irregularities shall be classified as "abrupt" or "gradual". Offsets caused by displaced or misplaced form sheathing or lining of form sections, or loose knots in forms or otherwise defective form work, will be considered as "abrupt" irregularities. All other irregularities will be considered as gradual irregularities.

(2) The formed surfaces which will be permanently buried under earth will require no treatment for abrupt or gradual irregularities. However, repair of defective concrete and filling of holes left by the removal of fasteners from the ends

of tie rods shall be undertaken.

(3) All abrupt and gradual irregularities at all exposed surfaces shall be removed by sack rubbing or sand blasting or grinding or by all these methods or any other method approved by the Engineer which is not harmful to the concrete. The permissible surface irregularities shall not exceed 6 mm for abrupt irregularities and 13 mm for gradual irregularities. The permissible irregularities may be reduced at places of the surface, where in the opinion of the Engineer, the formed finish does not provide the desired effect and no extra payment shall be permissible for such work. (see also Appendix A - Table of Tolerances).

(4) All surfaces such as blinding concrete, opening for second stage concrete etc on which concrete is to be placed subsequently, shall not be finished for abrupt or gradual irregularities.

Design Joints

538 (1) General

Design joints shall be formed in the positions and manner shown on the Drawings and shall be shuttered square to the work to provide a smooth surface to the concrete. The joints shall be made by forming the concrete on one side of the joint and allowing it to set before concrete is placed on the other side of the joint. The face of the joint first formed shall be smooth, dense and free from irregularities and honeycoming. The plane of the joint shall extend completely through the structure unless shown otherwise on the drawings.

Caulking grooves shall be provided as shown on the Drawings or in accordance with the joint sealant manufacturer's recommendations. At all joints where a caulking groove is formed, immediately prior to caulking, the groove shall be wire brushed and loose material removed and blown out by compressed air. After the groove has dried it shall be primed and caulked with approved sealant compound applied strictly in accordance with the manufacturer's instructions and to the approval of the Engineer.

(2) Contraction Joints

Contraction joints are defined as joints placed in structures or slabs to provide for volumetric shrinkage of a monolithic unit or movement between monolithic units. The joints shall be constructed so that there will be no bond between the concrete surfaces forming the joints. The surface of

the concrete first placed at a contraction joint shall be bitumen coated before the concrete on the other side of the joint is placed.

(3) Expansion Joints

Expansion joints are intended to accommodate relative movement between adjoining parts of a structure. A compressible filler shall be placed in the joint to provide freedom for the two adjacent concrete masses to expand. Care shall be taken to ensure that the material fills the joint completely and that no concrete or hard material is left in the joint after the second face of the joint has been cast.

Jointing Materials

539 (1) Joint Sealants

Joint sealants shall be approved bituminous compounds or elastomeric two part polysulphide sealants as shown on the Drawings. The grooves for the sealant shall be primed and a bond breakers shall be placed before application of the sealant. Such joint sealants, bond breakers, and the requisite priming materials shall be obtained from manufacturers approved by the Engineer. Application of joint sealants shall not be commenced without the Contractor having first obtained the approval of the Engineer. Sealants shall be stored in accordance with the manufacturer's recommendations and under no circumstances shall the material older than the recommended shelf life be used in the works.

(2) Compressible Filter

The Contractor shall supply and fix pre-moulded joint fillers in all expansion joints and where shown on the Drawings. Unless otherwise specified, the joint filler shall be of resin or bituminous bonded jute. The filler shall be obtained from a manufacturer approved by the Engineer and shall be stored and fixed in accordance with the manufacturer's instructions. The joint filler of the thickness specified shall be cut to shape and fixed to fill the whole space between the concrete faces of the joint sealer. Abutting pieces shall be placed in close contact and the joints covered on each side to prevent the passage of cement grout.

(3) Bitumen Coated Joints

Where the Drawings show bituminous paint between concrete faces, the Contractor shall clean and dry the face to which the paint is to be applied and shall then paint the bitumen on in two separate applications. The bitumen shall be a straight run

bitumen, grade 40/50 penetration, or other approved by the Engineer.

Precast Concrete

540 Concrete members specified to be fabricated as precast concrete units shall be fabricated with concrete of the specified class placed into a grout-tight mould. If so required the mould shall be laid on a vibrating table and vibration applied while the concrete is placed.

Permanently exposed surfaces shall have a finish obtained by casting the unit in properly designed moulds of closely-jointed wrought boards or steel or other suitable material. Where necessary the surface shall be improved in accordance with Sub-Clause 537(3).

With the approval of the Engineer the Contractor may be permitted to precast members which were specified to be constructed in-situ; in such cases the Contractor shall carry to the work as described above but payment shall be made in the manner appropriate to the method of construction originally specified. Generally members which are structurally dependent on a rigid fixing with the adjoining structures will not be permitted to be constructed by precasting.

Handling and Stacking of Precast Units

541 The Contractor shall give the Engineer full details of his proposed methods of handling and stacking precast concrete beams and units. The Engineer will examine these details and will either approve the methods or order modifications designed to ensure that no excessive stressess are set up in the beams or units. The finally approved methods are to be adhered to at all times and the Contractor shall be deemed to have included in his rates for all measures required to handle and stack beams and units safety and without undue stressing.

Records of Concreting

542 An accurate and up to date record showing dates, times, weather and temperature conditions when various positions of the Works were concreted shall be kept by the Contractor and shall be available for inspection by the Engineer. The Contractor shall also record the results of all tests of concrete and shall identify these results with the parts of the Works of which the sampled materials are representative.

SPECIFICATION

PART 6 - REVETMENT WORKS

General

601 The revetment works will comprise slopes formed by excavation and/or filling to the required profile, a layer of geotextile filter and armouring comprising concrete cubic blocks (c.c. blocks) above LWL + 2.00 m and c.c. blocks or rock below LWL + 2.00 m. Below this level the geotextile shall be reinforced by bamboo fascine or similar stiffening approved by the Engineer, to ensure a wrinkle-free blanket which will remain stable until the ballast layer is placed.

Geotextile-General

602 (1) All geotextiles shall be manufactured and supplied by a firm or firms of reputable geotextile manufacturers approved by the Engineer.

(2) Before placing an order for any quantity of geotextile, the Contractor shall submit to the Engineer for approval samples and test reports for each type of geotextile from an independent testing laboratory approved by the Engineer.

(3) The geotextiles to be incorporated within the Works shall comply with the appropriate codes and standards including the following:

ASTM D4491	Standard test methods for water permeability of geotextile by permittivity.
DIN 53936 Part 1	Determination of the water permeability coefficient k_{v1} normal to the geotextile plane with constant head.
ISO 9073-1	Determination of mass per unit area for non woven textiles.
ISO 9073-2	Determination of thickness of non-woven textiles.
ISO 9073-3	Determination of tensile strength and elongation of non-woven textiles.

The filter effective opening size, O_{90}, defined as being the grain size of a standard sand corresponding to 90% retention by weight on a sample of the geotextile in a vibrating sieve apparatus, shall be measured in a wet apparatus using the BAW (Bundesanstalt fur Wasserbau - German Federal Institute for Waterways Engineering) method.

(4) All geotextiles shall be clearly and uniformly marked on the upper face. The marking shall take the form of an indelible repeat roll imprint at the edge of each geotextile roll recurring at least every 1.5 m.

Geotextile Types

603 (1) Four types of geotextile will be required for the works and their respective properties are given in Clauses 604 to 607 hereof.

(2) Geotextile mats shall be stitched together with an approved stitch that will transfer at least 90 percent of the specified maximum tensile strength of the geotextile.

(3) Elongation shall be not less than 50 % in any direction as measured by ISO 9073-3.

Geotextile Type 1

604 Geotextile Type 1 shall be used for the revetment filter layer below LWL + 2.00 m and shall have a system to secure the fabric to the fascine mattress at 1 m centres. The Contractor shall demonstrate to the satisfaction of the Engineer that the system is sufficiently secure.

The material shall be a non-woven geotextile not less than 6 mm thick with a tensile strength not less than 20 kN/m. The geotextile shall be a polyester of the staple or continuous fibre type. O_{90} shall not be greater than 0.07 mm. The geotextile shall weigh not less than 0.8 kg/m^2 and have a permeability of not less than 3.0×10^{-3} m/s.

Geotextile Type 2

605 Geotextile Type 2 shall be used for the revetment filter layer above LWL + 2.00 m. The material shall be a non-woven geotextile not less than 6 mm thick with a tensile strength not less than 12 kN/m. The geotextile shall be of the staple or continuous fibre type, of polyster or UV stabilised polypropylene. O_{90} shall not be greater than 0.07 mm. The geotextile shall weigh not less than 0.8 kg/m^2 and have a permeability of not less than 3.0×10^{-3} m/s. A stabilising layer of geotextile shall be needle punched to the underside of the non-woven filter. This stabilising layer shall have O_{90} between 0.3 mm and 1.5 mm, and thickness between 5 and 15 mm.

Geotextile Type 3

606 Geotextile Type 3 shall be used for the manufacture of geotextile bags. The material shall be short staple non-woven geotextile of polyester or UV stabilised polypropylene weighing not less than 0.8 kg/m^2, and with O_{90} not greater than 0.07 mm.

Geotextile Type 4

607 Geotextile Type 4 shall be used for the filter layer below the slope protection on cross-bars and other flood control embankments constructed generally above nominal bank level. It shall be a non-woven geotextile of polyester or UV stabilised polypropylene of the staple or continuous fibre type. It shall be not less than 6 mm thick with a tensile strength not less than 12 kN/m and weigh not less than 0.8 kg/m^2. O_{90} shall not be greater than 0.07 mm and the permeability shall not be less than 3.0×10^{-3} m/s.

Geotextile Testing

608 Tests of mass per unit area, thickness, and tensile strength in accordance with the Standards listed in Clause 602 shall be carried out by an approved testing laboratory on samples taken from each quantity of 10,000 m^2 of geotextile fabric supplied. The k and O_{90} values shall be tested on samples taken from every 50,000 m^2 of geotextile fabric supplied. Seams shall be tested for tensile strength every 10,000 m of seam. The samples of the material as supplied shall be selected by a representative of the Engineer at the manufacturer's premises, prior to the first testing and any number of subsequent testings that the Engineer deems fit. During the manufacture of geotextile fabric continuous quality assurance testing by the manufacturer shall be carried out and the results of these tests shall be furnished to the Engineer by the Contractor prior to the use of the geotextile fabric on Site. Samples of work carried out on Site shall be selected by the Engineer's Representative.

The sample size for the fabric shall be 2 m^2 and shall be marked to indicate its upper side, longitudinal and transverse directions, type of geotextile and the date that the sample was taken. Seam samples shall be at least one metre in length and the ends of the threads are to be firmly tied off by the Contractor or Supplier at the time the samples are taken.

Each test shall be carried out on at least five samples.

The Contractor shall bear the expenses of all routine tests. Notwithstanding the submission of reports to the effect that the geotextile conforms to the Specification, the Engineer shall at all times be entitled to have additional samples of geotextile tested if he is of the opinion that the geotextile does not conform to the Specification. The Engineer shall only select samples from ends of geotextile rolls or geotextile which has been cut already.

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A geotextile will be regarded as defective if any of the specified values are not achieved other than those of unit weight and effective opening size, for which the following tolerances will be permitted:

(a) single layered geotextiles:

unit weight	- minus 10%
O_{90}	- plus or minus 20%

(b) composite geotextiles:

total weight	- minus 15%
single layer weight	- minus 20%
O_{90}	- plus or minus 20%

Transportation, Storage and Handling of Geotextile

609 (1) All geotextiles shall be transported, handled and stored in full accordance with the manufacturer's instructions. They shall be wrapped in black polyethylene sheeting to prevent UV exposure until immediately before use in the Works. If the wrapping is damaged during handling it shall be repaired immediately by the Contractor using additional black polyethylene sheeting. Unused portions shall be re-wrapped promptly.

(2) Geotextile fabrics arriving on site in containers shall be unpacked and stored under covers, well sheltered from rain and direct sunlight, until required for use in the Works. Sufficient ventilation under the shelter shall be provided so as to minimise the effects of high temperature thermo-oxidation.

(3) Torn or punctured geotextile fabric shall not be permitted in the Permanent Works.

(4) Geotextiles are to be covered with suitable materials within one week of being laid. When laying the covering material it shall not be dropped in the dry from a height greater than 2 m.

(5) Stock piles of materials are not to be set on top of laid geotextiles unless the geotextile has been designed for such loads.

(6) No construction equipment is to work on the geotextiles without at least 300 mm of suitable material overlying the geotextile.

(7) Overlaps of Type 2 geotextile shall be in accordance with the manufacturer's instructions but shall not be less than 1.0 m minimum width. Type 2

geotextile shall not be overlapped with the stabilising layer between the two filter fabrics.

Geotextile Bags

610 Geotextile bags shall be fabricated from geotextile Type 3 and shall be approximately 1.15 m wide by 2.30 m long. Each bag shall have a capacity of 0.65 m^3 and when filled shall be filled with 900 kg of sand which complies with the requirements of Clause 611 hereof.

Each bag shall be double stitched along all edges except for the opening at the top of each bag which shall be wide enough to allow the filling of the bag. The minimum tensile strength of the seam shall be not less than 90 % of the tensile strength of the geotextile. The top of each bag shall have a flap which shall be closed tightly after filling and then double stitched.

The bags shall be stored under cover, well sheltered from direct sunlight and to prevent the ingress of dust or mud. They shall be protected from damage by insects or rodents.

Sand Fill for Geotextile Bags

611 Sand fill for the geotextile bags shall, unless otherwise approved by the Engineer, comply with the following grading:-

	mm
d_{90}	0.60 to 0.30
d_{85}	0.50 to 0.25
d_{60}	0.40 to 0.20
d_{50}	0.35 to 0.20
d_{10}	0.20 to 0.05

Fascine Mattresses for Revetment

612 (1) Each mattress shall be Type 1 geotextile fastened to a fascine type grid.

Dimensions of individual mattresses will depend on the Contractor's method of construction and the sizes of his equipment. Individual mattresses shall be as large as possible so that the area of overlaps is minimised. 60 m x 30 m may be taken as an indicative size.

Overlaps of mattresses shall be in accordance with the manufacturer's instructions or advice, but at the time of placing not less than:

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above water level and in depth of water not exceeding 2 m:	1.00 m
depth greater than 2 m but less than 10 m:	1.50 m
depth greater than 10 m:	2.00 m

At the revetment terminations shapes other than rectangular will be allowed. The shortest side of a mattress shall be laid in a direction parallel to the current or predicted future current unless otherwise approved by the Engineer.

(2) A fascine type grid, in a 1 m x 1 m pattern, shall be fixed to the geotextile.

Bamboo used for fascine type grids shall be local bamboo having a diameter at the lower end of not less than 100 mm, a diameter at the upper end of not less than 50 mm and a length of not less than 5m.

The Contractor may propose an alternative material to bamboo for the Engineer's approval.

To achieve the necessary flexibility and to reduce buoyancy the bamboos shall be split and bound into bundles. At overlaps the thickness of the grid shall be reduced as shown on the Drawings.

Binding Rope

613 Binding rope for connecting fascines to the geotextile mattress shall be a composite rope (50/50) of polypropylene and other material, such as sisal, approved by the Engineer. The rope shall have a average weight of 0.020 kg/m and shall be sufficiently rough and pliable so that knots in the rope to fasten fascines to the geotextile mattress may be easily formed and secured. The breaking strength shall be at least 2500 N.

Preparation of Surface for Filter

614 The surfaces on which the geotextile filter and geotextile filter mattress are to be laid shall have a smooth finish to the specified tolerances, without abrupt change in level.

Geotextile Filter for Cross Bar Protection

615 The geotextile filter shall be a single layer of geotextile Type 4 laid in accordance with the manufacturer's instructions. Laps widths shall be no less than recommended by the manufacturer for the conditions to be encountered on the Site and the treatment of the laps shall also comply strictly with the manufacturer's recommendations.

Precast Concrete Cubic Blocks for Revetment

616 (1) Precast concrete blocks shall be made to the dimensions shown on the Drawings and to the specified tolerances. The materials and workmanship shall comply with the Specification herein in all respects. The Contract may be awarded on the basis of course aggregate either of crushed brick or stone.

(2) Precast concrete cubic blocks shall be concrete Class B as defined in Clause 510.

(3) Each block shall be marked with a consecutive number and the date of casting. The Contractor shall maintain a register of the number, date of casting, date and location of placing of each block and shall make the register available at all times for inspection by the Engineer.

(4) The Contractor may, subject to the approval of the Engineer, modify the geometry of the block slightly to facilitate its handling and placing e.g. by incorporating cylindrical holes or horizontal recesses. He shall at his own cost ensure that the finished weight of the block is the same as that of the blocks shown on the Drawings by adjusting the linear dimensions of the block accordingly.

Any consequent modifications to the design of the blocks shall be undertaken by the Contractor at his own cost and to the approval of the Engineer.

(5) Blocks shall not be stockpiled until they have been cured in accordance with Clause 529 hereof. They shall not be placed in the Works until at least twenty eight days after casting have elapsed or the specified strength has been attained.

(6) Blocks which are damaged during stockpiling, transport or handling shall be rejected and removed from the Site.

(7) Above LWL + 2.00 m the blocks shall be laid on the filter in rows parallel to the direction of the current. The blocks in each row shall be staggered half a block width from those in the row below. Adjacent blocks in the same row shall be laid with a gap between them of the minimum dimensions given below:

Block Size	Gap (mm)
0.60 m and less	10
larger than 0.6 m	20

The blocks shall be laid in manner so as not to damage or displace the underlying filter. Any damage caused to the filter during placing of the blocks shall be repaired by the Contractor at his own cost and to the satisfaction of the Engineer.

The outer face of the revetment above LWL + 2.00 m shall have a smooth and even appearance.

(8) Below LWL + 2.00 m blocks shall be laid by controlled dumping to achieve the required distribution of blocks. On the sloping revetment and in the apron blocks are to be placed to the profiles shown on the Drawings with a nominal voids radio of 40 percent. In any area of 20 m x 20 m the number of blocks placed shall not be less than that shown on the Drawings. The nominal thickness shall be achieved over at least 50% of the area and nowhere shall the coverage be less than 80% of that shown on the Drawings.

(9) Concrete block recovered from existing structures and suitable for reuse shall be placed in areas of the Works determined by the Engineer.

Rock Armour

617 (1) The Contract may be awarded for the provision of rock armour below LWL + 2.00 m, in which case the following sub-clauses shall apply:

(2) Quarry rock shall be obtained from blasting in a quarry approved by the Engineer. The Contractor shall satisfy himself that the sources of materials in Bangladesh or abroad have sufficient capacity to meet the requirements of the project. In the context of capacity, both the quantity of production and its compliance with the construction schedule should be taken into account.

(3) The following Standards shall apply:

- BS 812 : Testing aggregates
- ASTM C 88 : Aggregate soundness
- ASTM C 535: Abrasion resistance

(4) For straight revetments:

Nominal weight range	:	50 kg to 150 kg
Average weight	:	85 kg
Nominal size, D_{50}	:	0.32 m

For upstream terminations:

Nominal weight range	:	140 kg to 425 kg
Average weight	:	240 kg
Nominal size, D_{50}	:	0.45 m

For groyne heads:

Nominal weight range	:	225 kg to 680 kg
Average weight	:	385 kg
Nominal size, D_{50}	:	0.53 m.

The Contractor shall make allowance for breakage during handling and transport of the rock to ensure that the above specification is met.

The following requirements shall apply:

(i) The rock shall be free from dirt, sand, gravel and materials of organic origin (roots etc.).

(ii) The rock itself shall be good sound rock, without cracks or fissures, to avoid breaking during handling and placing or dumping.

(iii) Only rock with a factor not exceeding 2.5 between the longest and shortest dimension of the rock shall be allowed in the Works.

(iv) The impact value according to BS 812, part 3, Chapter 6 shall not exceed 30%.

(v) The average bulk specific gravity of any sample shall not be less than 2600 kg/m^3 (BS812, Part 2, Chapter 6, 3).

(vi) When subjected to the ASTM C 88 Sodium Sulphate Soundness Test, the weight average loss shall not exceed 10 % by weight.

(vii) Water absorption of rock material shall not exceed 6 % (BS 812, Part 2, Chapter 5).

(viii) When subjected to the Los Angeles Test, the percentage of wear shall not exceed 40 % (ASTM C 535)

(ix) Samples of 100 rocks taken at random from each 2000 t of rock delivered shall conform to the following grading:

For straight revetments

$$40\ kg < W_{min} < 60\ kg$$
$$W_{10} > 50\ kg$$
$$75\ kg < W_{av} < 115\ kg$$
$$W_{90} > 135\ kg$$

Where Wmin is the minimum weight of rock in the sample

W_{10} is the weight which 90 % of the sample shall exceed

Wav is the average weight of all the rocks in the sample

W_{90} is the weight which 10 % of the sample shall exceed.

For upstream terminations

$$120\ kg < W_{min} < 160\ kg$$
$$W_{10} > 140\ kg$$
$$220\ kg < W_{av} < 330\ kg$$
$$W_{90} > 380\ kg$$

For groyne heads,

$$200\ kg < W_{min} < 260\ kg$$
$$W_{10} > 225\ kg$$
$$340\ kg < W_{av} < 465\ kg$$
$$W_{90} > 600\ kg$$

(5) Approval of Rock Sources

The quarry rock shall be supplied only from sources approved by the Engineer in writing. Such approval to be given for each quarry or source will be site specific with regard to the name and location of the source and the quantity of rock to be delivered from that source.

(6) Testing of Rock Sources

(i) The Contractor shall bear the cost of testing of the materials and for the test material itself.

(ii) The Contractor shall undertake or arrange for the undertaking of the specified tests on rock samples to the Engineer's satisfaction and in compliance with the Specification.

(iii) All test results shall be presented on standard test forms approved by the Engineer prior to commencement of the work.

(iv) The stone materials at the quarry or source shall be sampled at least once for each 2000 t of rock. If the rock does not comply with the Specification then more samples shall be taken for testing.

(v) If a rock sample is found to be below the requirements of the Specification, the Engineer will require that more frequent samples be taken until production is within Specification.

(vi) The Contractor shall arrange for delivery and testing of materials at a location to be approved by the Engineer.

(vii) The samples for testing shall be taken by random selection to obtain a representative sample. A sample for determination of weight gradation shall contain at least 100 individual rocks.

(viii) The results of the tests shall meet the requirements given in Sub-Clause (4) (ix) of this Clause.

(ix) In case the results do not comply with the Specification, the Engineer will order that production and collection of rock be stopped until the problem is overcome and production again complies with the Specification.

(7) Testing at Construction Sites

(i) Testing at Construction Sites shall take place at the Contractor's expense, and the location for testing shall be arranged by the Contractor and approved by the Engineer.

(ii) The materials arriving at the Construction Site shall be tested at least once for each 2000 t of rock delivered.

(iii) Should the tests show non-compliance of rock delivered the Engineer may order more tests to be performed.

(iv) Should such tests show non-compliance the Engineer may reject whole or part of the rock delivery.

Rejected material shall be removed from the Construction Site by the Contractor at his own expense.

(v) The Engineer may order tests performed on each delivery of rock that in his opinion does not comply with the Specification. The Engineer may likewise order that samples be taken from different parts of a delivery or stockpile should he suspect the material not to be in accordance with the Specification.

(vi) The samples for testing may be taken at the unloading point or from the stock pile of rock.

Samples shall be taken at random to be representative. Sub-samples for determination of weight gradation shall be merged into one large sample containing a minimum of 100 individual rocks.

(vii) The testing of the rock is specified under "Testing of rock sources".

(8) Stock Piling of Materials:

The Contractor shall within 60 days of the Commencement Date submit his proposed plan and procedures for rock handling and stockpiling. The stockpile shall be established at a location approved by the Engineer. Separate stockpiles shall be provided for the different categories of rock.

Any material rejected by the Engineer or spoiled due to operation or handling by the Contractor shall be removed immediately from the Site.

(9) Stock-Pile for Future Maintenance Work:

The Contractor shall as stipulated in the Contract deliver stockpiles for future maintenance work. This material shall fulfil the requirements stated above for construction materials and shall be stored at a selected location designated by the Engineer.

Brick Filter Layer

618 (1) Bricks for the khoa filter layer above LWL + 2.00 m and as placed on the geotextile/fascine mattress below LWL + 2.00 m shall comply with the requirements for bricks as stated in Sub-Clause 505(5).

(2) The khoa filter layer shall comply with the grading given in Table 618 below:

Table 618

BS 410 Standard Mesh (mm)	Percentage by Weight Passing
75.0	100
37.5	90-100
20.0	0-30

(3) Bricks on the geotextile/fascine mattress shall be whole or half bricks.

Revetment Construction Method

619 Notwithstanding the requirements for submission of a method statement as part of his Tender, the Contractor shall, within 60 days from the Commencement Date submit a detailed statement of his proposed working methods to the Engineer for approval. The method statement shall include:

(i) The numbers, types, and performance details of plant and equipment, both floating and land based

(ii) provisions for stockpiling, handling and storage of materials

(iii) the layout of individual mattresses and provisions for overlaps

(iv) survey and positioning systems for placing materials

(v) working methods and sequence for construction of the linear revetment(s) and terminations.

(vi) monitoring system for verification that the working methods meet the requirements of the Specification and the Drawings.

Approval by the Engineer of the Contractor's method statement shall not relieve the Contractor of his obligation to construct the Works in accordance with the Specification and the Drawings.

Brick Mattressing

620 (1) Bricks for brick mattressing shall comply with the requirements for bricks stated in Sub-Clause 505(5).

(2) The hexagonal wire netting shall be manufactured from 12 SWG galvanized wire with a maximum mesh size of 100mm. The width of the wire netting roll shall be 2m or as otherwise or approved by the Engineer.

(3) The mattress shall be secured by 1.50m long Gozari ballah anchors driven to a depth of 1.30m and set at 2m centres or as directed by the Engineer. The Gozari ballah poles used for anchors shall have a diameter of between 100mm and 150mm, measured at the one third point from the thicker end.

(4) The anchors shall be installed at position approved by the Engineer, and shall be driven to the specified depth before the wire netting and bricks are placed.

(5) The wire netting shall be spread and fixed in position to the anchors. Successive wire netting sheets shall be lapped by 150mm.

(6) One layer of flat brick soling shall be placed on the wire netting and the second layer of bricks shall be laid in a herring bone bond pattern. On completion of the two brick layers, a second layer of wire netting with 150mm laps shall be laid on top.

(7) The wire netting shall be tied top and bottom by 2 ply 12 BWG galvanized wire at 600mm intervals in both directions and firmly tied to the Gozari ballah anchors.

Brick Road Pavement and Footpath

621 (1) A single layer of flat brick soling of first class bricks shall be placed on the khoa

roadbase to the cross fall shown on the Drawings with the long edge of each brick in a transverse direction.

(2) The road surface shall be formed by picked Jhama bricks, laid in a herring bone bond pattern on a 10mm cushion of sand (fineness modulus greater than 0.8) over the flat brick soling to maintain the cross fall.

(3) The joints between the edging, flat soling and herring bone bond bricks shall be filled with sand (fineness modulus greater 0.5) and watered into place.

(4) The herring bone bond brick footpath hall be laid in accordance with Sub-Clauses (1), (2) and (3) of this Clause, except that the flat brick soling shall be omitted.

BRAHMAPUTRA RIGHT BANK PHASE 1 WORKS

APPENDICES TO SPECIFICATION

APPENDIX A

TABLE OF TOLERANCES

The following are the tolerances within which the Works are to be executed:-

Dry Earthworks		
Top level of fill after compaction		+ 200 mm - 000
Excavated levels		± 150 mm
Side slopes of banks, embankments and cuttings		+ 150 mm) over 10m - 000)
Formation for structures		+ 000 mm
Dredging		
Excavated bed and slope levels		± 500 mm
Deviation from level		± 1 vert: 5 hor
Concrete Blocks		
Linear dimension		± 3 mm
Surface (any direction)		± 2 mm
Gap between blocks		+ 10 mm - 000
Structural Concrete		
Lengths	up to 3 m	± 6 mm
	3 m up to 6 m	± 10 mm
	6 m upwards	± 13 mm
Cross section (each direction)		
	up to 500 mm	± 6 mm
	500 mm to 1m	± 10 mm
	1m upwards	± 13 mm
Straightness or bow (deviation from intended line)		
	up to 3 m	± 6 mm
	3 m to 6 m	± 10 mm
	6 m upwards	± 13 mm
Level of concrete		± 6 mm
Reinforcement		
Maximum departure in required bar spacing		25 mm

APPENDIX B

SCHEDULE OF ACCOMMODATION FOR THE ENGINEER

The Contractor shall provide, equip and maintain for the sole use of the Engineer and his staff the office, laboratory including testing equipment, and living accommodation as specified herein and in Clauses 235, 236 and 237. The testing equipment for the laboratory shall be as listed in Appendix E.

The facilities shall be constructed in an area at least 750 mm above HFL or otherwise adequately protected against flooding, on a compacted earth fill area developed by the Contractor. The Contractor shall prepare for the Engineer's approval working drawings of the facilities incorporating the minimum floor areas and number of rooms indicated below. Proprietary makes of prefabricated buildings to standards approved by the Engineer will be acceptable. Such buildings shall be erected on concrete foundations.

The laboratory shall be provided with double doors to facilitate the offloading of samples. The floor of the laboratory working area shall be fine face concrete laid to falls to a central drainage channel. A ramp shall be provided to the double doors.

The Contractor shall arrange for any site grading required for drainage of the developed area including drains, access by means of paved roads and paved covered parking areas adjacent to the Facilities. The entire facility shall be fenced to ensure security including guard house, lockable steel gate at the entrance to the fenced area and external lighting and watchmen to the satisfaction of the Engineer.

The entire facility shall be provided with electricity supply including all exterior and interior wiring, telephone service, water supply sewerage and gas for fuel in the kitchens. Air conditioners shall be provided for all offices, conference room, laboratory, and in all bedrooms and lounge/dining rooms in the houses. The Contractor shall pay all charges, fees or other expenses for maintaining, supplying and replenishing the utilities and services for the entire facility.

The minimum ceiling height of all buildings shall be 2.75 m and the floor shall be covered with vinyl tile or similar washable covering. Each toilet shall be provided with hot and cold water supply, wc, wash basin, shower rose, towel rail, toilet paper holder, mirror with soap rack and adequate draining system. All bedrooms in the guest house shall be of the same floor area.

Equipment for the use by the Engineer shall be as listed and specified in Appendix D.

Accommodation for the Engineer

1. Office

Facility	Floor Area (m^2)	No	Total Area (m^2)
Office	21.0	6	126.0
Office	14.0	3	42.0
Office	10.5	3	31.5
Office	7.0	1	7.0
Reception	10.5	1	10.5
Conference Room	21.0	1	21.0
Print Room	7.0	1	7.0
Kitchen	7.0	1	7.0
Changing Room	10.5	1	10.5
Toilets	1.75	6	10.5
Store	3.5	1	3.5
Corridor	-	-	43.5
TOTAL FOR ENGINEER'S OFFICE			320.0

2. Laboratory

Office	21.0	1	21.0
Office	14.0	1	14.0
Office	7.0	1	7.0
Working Area	72.0	1	72.0
Toilets	1.75	1	1.75
Store	5.25	1	5.25
Corridor	-	-	7.0
TOTAL FOR ENGINEER'S LABORATORY			128.0

Accommodation for the Engineer

Housing

Accommodation Unit	No.	Floor Area (m^2)	Bed-rooms (no)	Lounge Diner (no)	Toilet (no)	Shower/ Bath (no)	Kitchen (no)
House Type A	2	150	3	1	2	2	1
House Type B	2	120	3	1	2	2	1
House Type C	8	90	3	1	1	1	1
House Type D	8	80	2	1	1	1	1
Guest House	1	150	3	1	3	3	1
10-bed Mess Unit	2	300	10	1	10	10	1

APPENDIX C

SCHEDULE OF TRANSPORT FOR THE ENGINEER

The Contractor shall provide land and water transports as specified below, for the exclusive and full time use of the Engineer and his staff for the entire duration of the Contract. The transport shall be brand new and of makes approved by the Engineer.

Land transport

(a) 4WD Pick-up

Pick-ups shall have a 4 wheel drive system with a sturdy 4-door body, strong bumpers and minimum gradeability and angle of stability of 30^0 and 40^0 respectively. Fording depth shall be at least 600 mm with minimum approach and ramp clearance of 40^0 and 30^0 respectively when fully loaded.

The suspension shall be tough and capable of providing a comfortable and smooth ride on highways, poor and very rough roads and off-road conditions.

The interior shall be airconditioned, dust proof, reasonably spacious and seat 4 persons.

The load bed shall have at least 1800 mm clear length and 1400 mm width with strong tailgate fitted with chain and cargo hooks.

(b) 4WD LWB

The 4 WD Long Wheel Base vehicles (LWB) shall have a 4 wheel drive system, 5 doors and seating capacity for 6 persons. The body and bumpers shall be of sturdy construction with minimum gradeability of 30^0 and angle of stability of 40^0. Fording depth shall be at least 600 mm with minimum approach and ramp clearance of 40^0 and 30^0 respectively when fully loaded.

The suspension shall be tough and capable of providing a comfortable and smooth ride on highways, poor and very rough roads and off-road conditions. The interior shall be dust proof and airconditioned with the option of good ventilation. The wind shield and the rear window shall be fitted with demister and wipers.

Water transport

Speed Boats

Speed boats shall have a fibreglass hull with canvas auning on detachable aluminum ribs, inboard steering wheel and seating capacity for a minimum of 6 passengers.

The engine shall be outboard type, fuel efficient, fitted with dynamo connected to the battery and capable of generating a speed of 10 knots or more against normal river currents.

The speed boat shall be fitted with anchor and fenders, 100 watt halogen search light, and port, starboard and stern lights.

Transport for the Engineer

4 WD Pick-up	10
4 WD LWB	4
Speed Boat	4

APPENDIX D

SCHEDULE OF EQUIPMENT FOR USE BY THE ENGINEER

The Contractor shall provide equipment and furniture for the sole use of the Engineer for his office, laboratory, store, accommodation units, and for survey and measurement. The equipment and furniture shall be brand new and according to the specification and provisional quantity shown in the following lists. The Contractor shall maintain, provide necessary servicing and replace defective or unusable equipment and furniture to the satisfaction of the Engineer throughout the Contract. The equipment and furniture shall be subject to the approval of the Engineer prior to their supply.

(a) Furniture and Equipment for Engineer's Office

Item	Quantity
Desk double pedestal, 1.5m x 1.0m	1
Desks, single pedestal, 1.2m x 0.75m	29
Chairs, swivel on castors (cloth upholstery) with arms	4
Chairs, swivel on castors without arms (Secretarial)	1
Chairs, (cloth upholstery) with arms	31
Chairs, (cloth upholstery) without arms	44
Filing cabinets (locking), 4 drawer legal size	14
Steel cupboards 1.6m x 1.0m x 0.6m	6
Desk, 'L' shaped secretarial unit	1
Book cases, 1.0m x 1.0m, 3 shelves	12
Desk, 1.0m x 3.0m Conference	1
Desk, 1.0m x 2.3m Conference	1
Bulletin board, 1.2m x 2.5m	3
Bulletin board, 1.2m x 3.5m	1
Fire extinguisher	3

First aid box	3
Safety helmets (white or yellow)	37
Orange life jackets	9
Filing trays, waste paper basket, ashtray	33 Sets
General office equipment - punch, stapler etc	33 Sets
Desk Calculator, electronic, scientific	24
Desk Calculator, electronic, programmable	3
PC Desk Top 385/25 speed 25 MHz INTEL 80386-25 PROCESSOR or similar approved, 64 KB with wide carriage lazer printer and UPS etc.	3 Sets
Table, drafting board, with parallel action	2
Stool, drafting (cloth upholstery)	2
Drafting equipment - steel straight edges, scales, compasses	2 Sets
Leroy of similar approved drawing pens and lettering templates, set squares, protractors etc.	As required
Planimeter	1
Railway curves (metric)	1 Set
Anglepoise drawing board lamp	2
Ammonia dye line plan printing machine, plus an extractor unit	1
Guillotine, with 1.5 width capacity	1
35 mm single lens reflex camera	2
35 mm colour print film	As required

Plastic 5 litre insulated cooled water container	7
Kitchen floor units c/w work top	As required
Waste paper basket	35
Kitchen wall units	As required
Kitchen equipment	As required
Photocopying machine, dry toner-desk top with cabinet A3 size	1
Telephone (no of handsets)	11
PABX system or similar connecting all handsets	1
Automatic water cooler	2
Plain paper fax machine (Group 3) with storage memory and automatic dial	1

* As required means quantity and specific standard approved by the Engineer

(b) **Survey Equipment**

Item	Quantity
Wild T2 theodolite inclusive of tripod	2
Wild NAK 1 automatic level and tripod	2
Staffs for levelling	4
30 metre steel tape	3
100 metre steel tape	3
5m pocket tape	15
3m pocket tape	15
Ranging rod	16
Ranging rod stand	4
Surveying pins	As required

Optical square	7
Lump hammer (4 lbs)	7
Sledge hammer (7 lbs)	3
Portable "Surveying" safety sign	4
Surveying marking material	As required
Surveying umbrella	8
Torch (9 volt)	8
Plumb bobs and lines	4
String chalk lines	As required
Safety harness	2
Echo sounder - Atlas duel frequency type or equivalent	1 Set
Electronic Positioning System - same as used by Contractor	1 Set
Track plotter	1
Recording and processing units to produce cross-sections and charts of surveyed areas	1 Set

(c) Fixtures and Fitting for Laboratory

Item	Quantity
Work benches, 900 x 750 deep c/w work top and shelf under	10 lin.m
Cupboards beneath work benches including shelf	5 lin.m
Cupboards - wall mounted, 400 deep 900 high with shelf	5 lin.m
1.2 m high bulletin board	10 lin.m
Belfast pattern sink c/w plumbing	1 No.
Kitchen equipment	As required
Metal rack shelving system	20 lin.m
Desk double pedestal, 0.8m x 2.0m	2
Desk single pedestal, 1.2m x 0.75m	5
Table, Reference, 1.2m x 1.8m	6
Chair, swivel on castors (cloth upholstery)	7
Chair, without arms (cloth upholstery)	7
Filing cabinets (locking) 4 drawers, legal size	7
Steel cupboards 1.6m x 1.0m x 0.6m	2
Bulletin Boards 1.2m x 2.5m	3
Book cases 1.0m x 1.0m, 3 shelves	1
Filing Trays, waste paper basket, ashtray	7 Sets
General office Equipment - punch, stapler, sharpens	7 Sets
Desk Calculator, electronic scientific with printout with wide carriage printer	1
Desk calculator, electronic, scientific	6
First Aid box	1

Fire Extinguisher	2
Automatic Water Cooler	1
5 m pocket tape	3
3 m pocket tape	4
Wooden laboratory stools	8
Telephone (no. of handsets)	2
Safety Helmet (White or Yellow)	7
Orange Reflective jacket	2

(d) **Furniture and Equipment for Accommodation Units**

Accommodation Units listed under Appendix B shall be provided with all the necessary hard furnishings including refrigerators, electric or gas 4 hob units with ovens, washing machines, installation for hot and cold water, washing facilities and sanitary fittings. Kitchens shall include appropriate fully fitted units to a specific standard approved by the Engineer.

Similarly all loose and built-in furniture, bedding, floor coverings, curtains, etc. shall be to a specific approved standard. Accommodation units as listed in Appendix B shall be supplied with sets of soft furnishings, cutlery, crockery and cooking utensils appropriate to the specific unit.

APPENDIX E

SCHEDULE OF TESTING EQUIPMENT FOR THE ENGINEER

Laboratory Apparatus

The Contractor shall provide and equip the Engineer's laboratory to carry out the tests specified below. The Contractor shall maintain all equipment in good working order, replace any broken items and supply the required chemicals.

The number of items of equipment and quantities of materials and chemicals to be supplied shall be sufficient to conduct an equivalent number of tests to that required of the Contractor in accordance with the Specification.

1. Soil Testing (the numbers given in brackets refer to the tests as specified in BS 1377):

   (a) Determination of moisture content (1A)

   (b) Determination of liquid limit (2A)

   (c) Determination of plastic limit (3)

   (d) Determination of plasticity index (4)

   (e) Determination of linear shrinkage (5)

   (f) Determination of specific gravity of soil particles (6A and 6B)

   (g) Determination of particle size distribution (down to sieve size 200) (7B)

   (h) Determination of particle size distribution (fine grained soils - pipette method) (7C)

   (i) Determination of dry density/moisture content relationship (2.5 kg rammer method) (12)

   (j) Determination of dry density of soil on the site (15B)

   (k) Contract No. 2 only. Determination of California Bearing Ratio (16)

2. Concrete Testing (the part and clause numbers refer to the tests or procedures as specified in BS 1881).

   (a) Aggregate moisture tests for determination of water cement ratio

   (b) Slump test — Part 2, Clause 2

   (c) Compacting factor test — Part 2, Clause 3

(d)	Making and curing test cubes*	Part 3, Clause 2
(e)	Compression testing of test cubes*	Part 4, Clause 2

* or test cylinders

3. Cement Testing (the section numbers refer to the tests in BS 4550 Part 3):

(a)	Compressive strength (mortar cubes)	Section 3.4
(b)	Setting time	

4. Fine and Coarse Aggregate Testing

(a)	Silt, clay and dust fraction	BS812	Part 1, Para 7.2
(b)	Flakiness index	BS812	Part 1, Para 7.4
(c)	Elongation index	BS812	Part 1, Para 7.4
(d)	Water absorption	BS812	Part 2, Para 6
(e)	Particle size and grading	BS812	Part 2, Para 7.1
(f)	Silt content by field settling test	BS812	Part 2, Para 7.1
(g)	Aggregate crushing value	BS812	Part 2, Para 7
(h)	10 per cent fines value	BS812	Part 3, Para 8
(i)	Soundness	ASTM C88	
(j)	Alkali - aggregate reactivity	ASTM C289	
(k)	Shrinkage		
(l)	Soluble sulphates		

5. Water Testing — BS 3148

(a) Organic and inorganic matter in solution and suspension

(b) Sulphate content

(c) Alkali bicarbonate/carbonate

6. Rock Testing (where the Contract in awarded for rock armouring)

(a) Abrasion test — ASTM C535

APPENDIX F

LIST OF DRAWINGS

Drawing Titles	Drawing Nos.
o Location & Site Plan	BRT/MPR/B*/001
o Working Area	BRT/MPR/B*/002
o Typical Sections	BRT/MPR/B*/003
o Revetment Cross-Sections	BRT/MPR/B*/004
o Details of Upstream Termination	BRT/MPR/B*/005
o Details of Downstream Termination	BRT/MPR/B*/006
o Details of Typical Cross-Bar & Access Road	BRT/MPR/B*/007
o Typical Geotextile Filter Arrangement	BRT/MPR/B*/008
o Mooring Details for Country Boat	BRT/MPR/B*/009

APPENDIX G

SCHEDULE OF TELECOMMUNICATIONS

(a) **Telephone**

The Contractor shall provide, install and maintain the necessary equipment for connection into the public telephone system. The Contractor shall provide, install and maintain all necessary telephone extensions including instruments for the Engineer's office and laboratory. Three direct outside telephone lines, which shall be separate lines to the Contractor's, shall be provided for the Engineer's office and laboratory, with an interconnecting PABX or similar system.

(b) **Internal Telephone System**

The Contractor shall supply, install, operate on a 24 hour basis and maintain an internal telephone system with access to outside direct lines connecting the Engineer's office, laboratory and accommodation including the guest house. This facility may be combined with the Contractor's own facilities.

(c) **Telefax and Telex Communication**

The Contractor shall provide, install and maintain for the Engineer's office telefax and telex equipment for the sole use of the Engineer.

(d) **Two-way radios**

The Contractor shall provide and maintain two-way radio handsets, 8 Sets for Contract No. 1 and 6 sets for Contract No. 2. The equipment shall have the capability of transmitting and receiving signals within an area of 3 to 4 km radius during stormy and clear weather. The necessary license(s) for the equipment shall be obtained by the Contractor from the appropriate Authority. The Employer shall render all necessary assistance to the Contractor in obtaining permits, licences etc.

(e) **Radio Master Station**

The Contractor shall provide and maintain, for the sole use of the Engineer, a central radio master station at the Engineer's office and two-way radios in the boats and vehicles provided for the Engineer. A provisional sum for this work is provided in Bill No. 1, and a supplementary specification will be issued after the Commencement Date.

APPENDIX H

LIST OF STANDARDS

(Two sets to be provided in accordance with Specification Clause 202)

1	BS 12
2	BS 410
3	BS 812
4	BS 882
5	BS 1377
6	BS 1452
7	BS 1881
8	BS 3148
9	BS 4449
10	BS 4461
11	BS 4482
12	BS 4483
13	BS 4486
14	BS 5750
15	BS 8110
16	DIN 53936 Part 1
17	ISO 9073-1
18	ISO 9073-2
19	ISO 9073-3
20	ASTM C42
21	ASTM C88
22	ASTM C535
23	ASTM D4491

BRAHMAPUTRA RIGHT BANK PHASE 1 WORKS

SECTION 11: DRAWINGS

Drawing No. BRT/MPR/B3/001	Contract No. B3: Sariakandi North and Naodabaga Location and Site Plan
Drawing No. BRT/MPR/B4/001	Contract No. B4: Sailabari and Simla Location and Site Plan
Drawing No. BRT/MPR/B5/001	Contract No. B5: Fulchari Location and Site Plan
Drawing No. BRT/MPR/B6/001	Contract No. B6: Kazipur Location & Site Plan
Drawing No. BRT/MPR/B7/001	Contract No. B7: Betil Location and Site Plan
Drawing No. BRT/MPR/B3/002	Contract No. B3: Sariakandi North and Naodabaga Working Areas
Drawing No. BRT/MPR/B4/002	Contract No. B4: Sailabari and Simla Working Areas
Drawing No. BRT/MPR/B5/002	Contract No. B5: Fulchari Working Areas
Drawing No. BRT/MPR/B6/002	Contract No. B6: Kazipur Working Areas
Drawing No. BRT/MPR/B7/002	Contract No. B7: Betil Working Areas
Drawing No. BRT/MPR/B*/003	Contract No. B* Typical Sections
Drawing No. BRT/MPR/B*/004	Contract No. B* Revetment Cross-Sections
Drawing No. BRT/MPR/B*/005	Contract No. B* Details of Upstream Termination
Drawing No. BRT/MPR/B*/006	Contract No. B* Details of Downstream Termination
Drawing No. BRT/MPR/B*/007	Contract No. B* Details of Typical Cross-Bar & Access Road
Drawing No. BRT/MPR/B*/008	Contract No. B* Typical Geotextile Filter Arrangement
Drawing No. BRT/MPR/B*/009	Contract No. B* Mooring Details for Country Boat

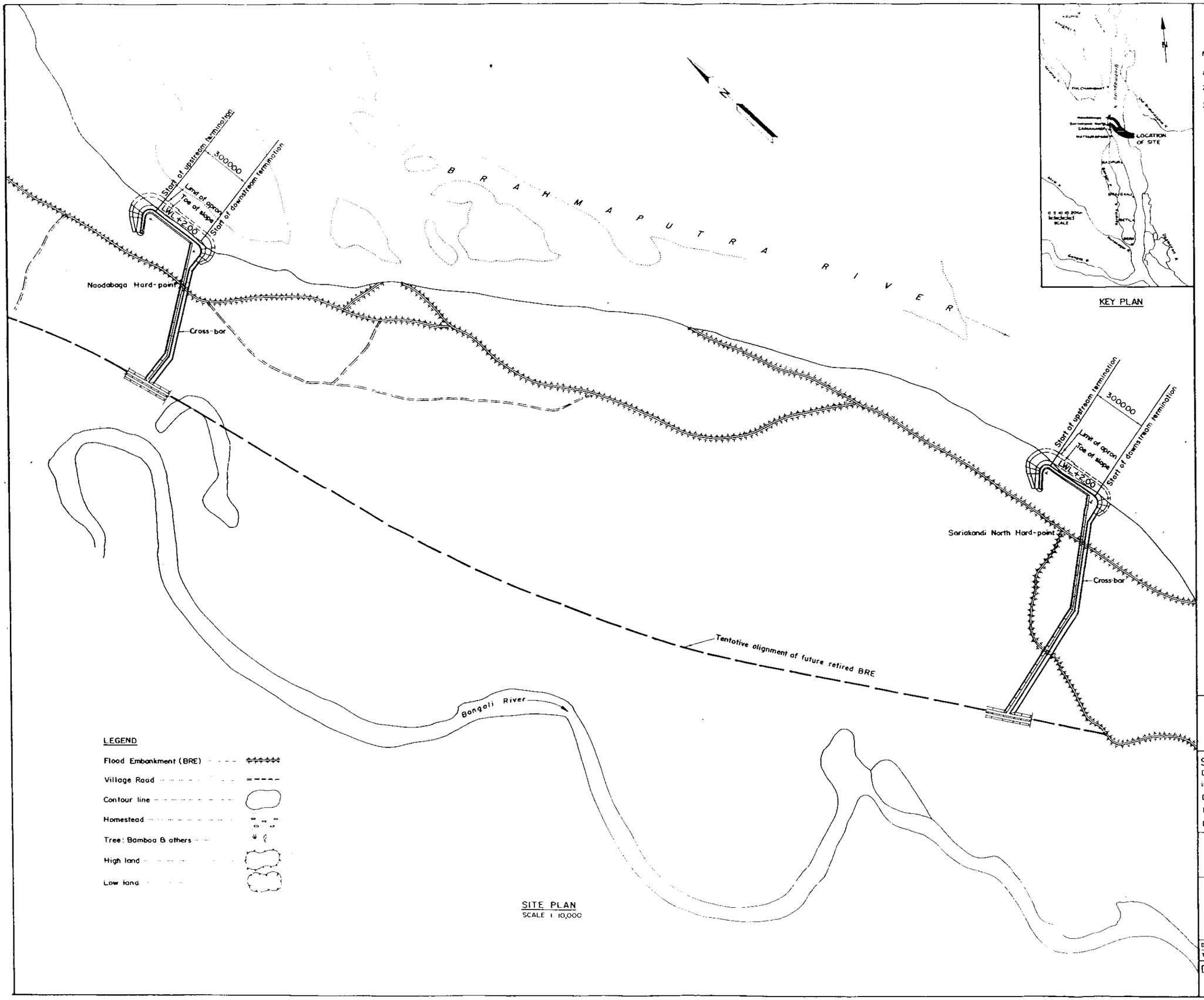
N.B. Drawings nos./001 and 002/ are site specific.
Drawings nos./003 through/009 are common to all contracts, denoted B*

165

NOTES

1. All elevations are in metres above PWD datum
2. All dimensions are in millimetres
3. Cross-bar extension to future retired position of embankment See drawing no BRT/MPR/B✱/007
4. Topographic information shown is based on surveys carried out in (to be completed after detailed survey.)
5. For details of revetment section with access road, See drawing no BRT/MPR/B✱/007
6. For upstream termination detail, See drawing no BRT/MPR/B✱/005
7. For downstream termination detail, See drawing no BRT/MPR/B✱/006
8. For typical cross-sections refer to drawing no. BRT/MPR/B✱/004
9. ✱ : insert contract number prior to tender
10. Locations of hard-points to be confirmed prior to construction

KEY PLAN



LEGEND

- Flood Embankment (BRE)
- Village Road
- Contour line
- Homestead
- Tree; Bamboo & others
- High land
- Low land

SITE PLAN
SCALE 1 10,000

BANGLADESH WATER DEVELOPMENT BOARD

Sir William Halcrow & Partners Ltd.
Dhaka, Bangladesh
in association with
Danish Hydraulic Institute
Engineering & Planning Consultants Ltd
Design Innovations Group

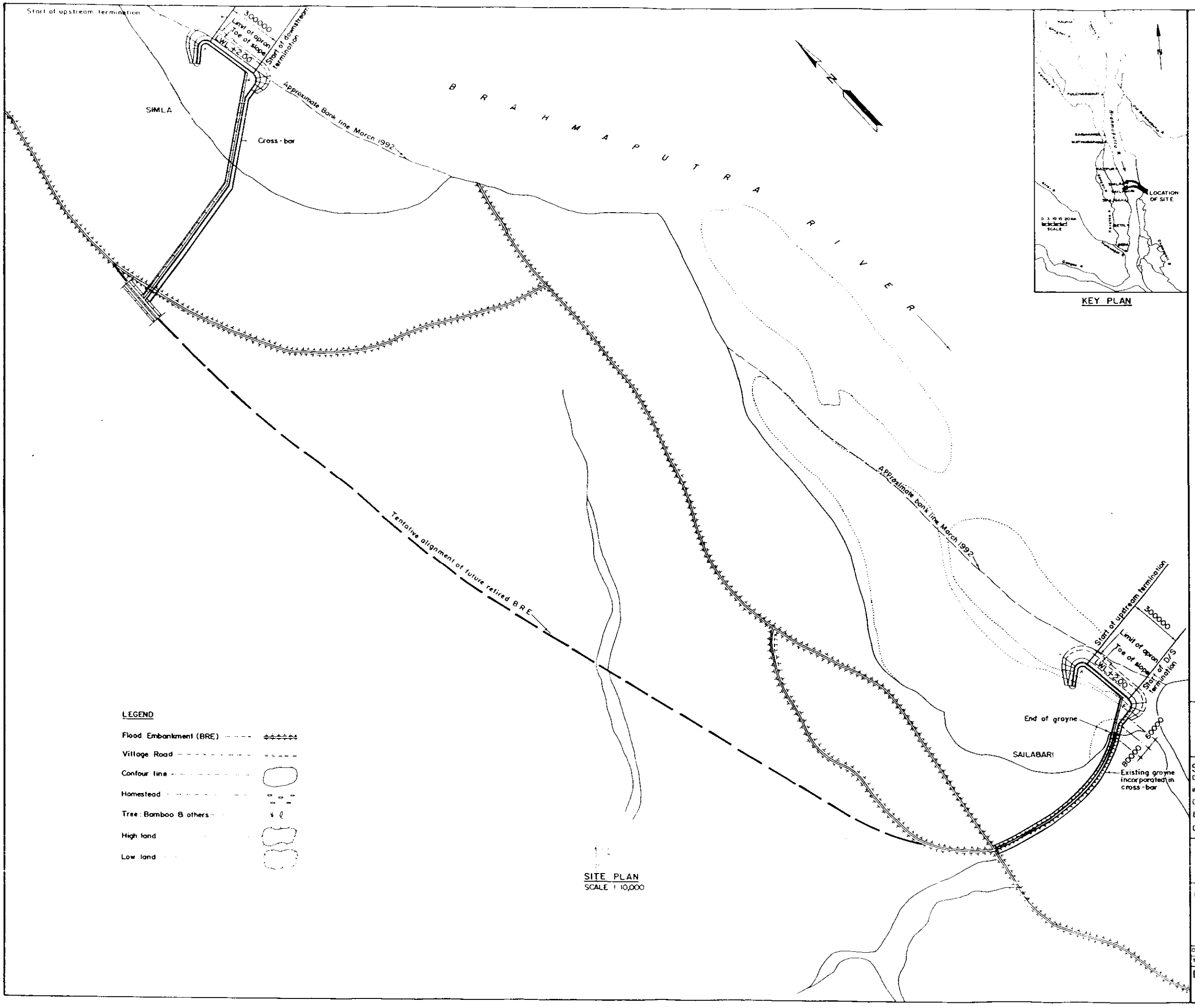
RIVER TRAINING STUDIES OF THE BRAHMAPUTRA RIVER

CONTRACT NO. B3 SARIAKANDI NORTH AND NAODABAGA

LOCATION & SITE PLAN

DRAWN		CHECKED	APPROVED
TRACED		SCALE 1/10,000	DATE MAY 1993

DRAWING NO BRT/MPR/B3/001



SITE PLAN
SCALE 1 10,000

KEY PLAN

L66

NOTES

1. All elevations are in metres above PWD datum
2. All dimensions are in millimetres
3. Cross-bar extends to future retired position of embankment See drawing no. BRT/MPR/BE#/007
4. Topographic information shown is based on surveys carried out in (to be completed after detailed survey)
5. For details of revetment section with access road, See drawing no. BRT/MPR/B#/007
6. For upstream termination detail, See drawing no. BRT/MPR/B#/005
7. For downstream termination detail, See drawing no. BRT/MPR/B#/006
8. For typical cross-sections refer to drawing no BRT/MPR/B#/004
9. # : insert contract number prior to tender
10. Locations of hard points to be confirmed prior to construction

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Design Innovations Group

RIVER TRAINING STUDIES OF THE BRAHMAPUTRA RIVER

CONTRACT NO. B4 : SAILABARI AND SIMLA

LOCATION & SITE PLAN

DRAWN		CHECKED	APPROVED
TRACED		SCALE 1 10,000	DATE MAY 1993

DRAWING NO BRT/MPR/B4/0001

B R A H M A P U T R A R I V E R

300000

Start of upstream termination

Start of downstream termination

Limit of apron

Toe of slope

LWL +2.00

Approximate Bank line March 1992

Cross-bar

Alignment of existing embankment

FULCHARI GHAT

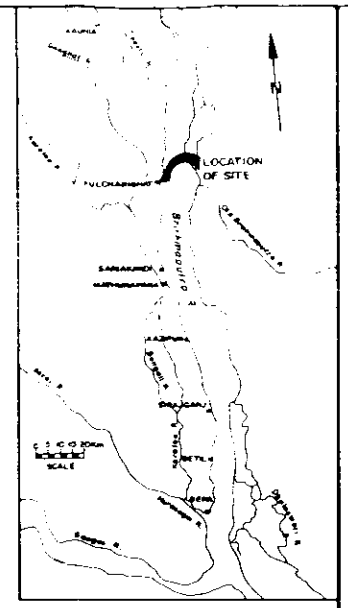
Existing BRE

Railway line

SITE PLAN
SCALE 1:10,000

LEGEND

- Flood Embankment (BRE)
- Village Road
- Contour line
- Homestead
- Tree: Bamboo & others
- High land
- Low land



KEY PLAN

NOTES

1. All elevations are in metres above PWD datum
2. All dimensions are in millimetres
3. Cross-bar extends to future retired position of embankment. See drawing no. BRT/MPR/B*/007
4. Topographic information shown is based on surveys carried out in (to be completed after detailed survey)
5. For details of revetment section with access road, See drawing no. BRT/MPR/B*/007
6. For upstream termination detail, See drawing no. BRT/MPR/B*/005
7. For downstream termination detail, See drawing no. BRT/MPR/B*/006
8. For typical cross-sections refer to drawing no. BRT/MPR/B*/004
9. * : insert contract number prior to tender
10. Locations of hard-points to be confirmed prior to construction

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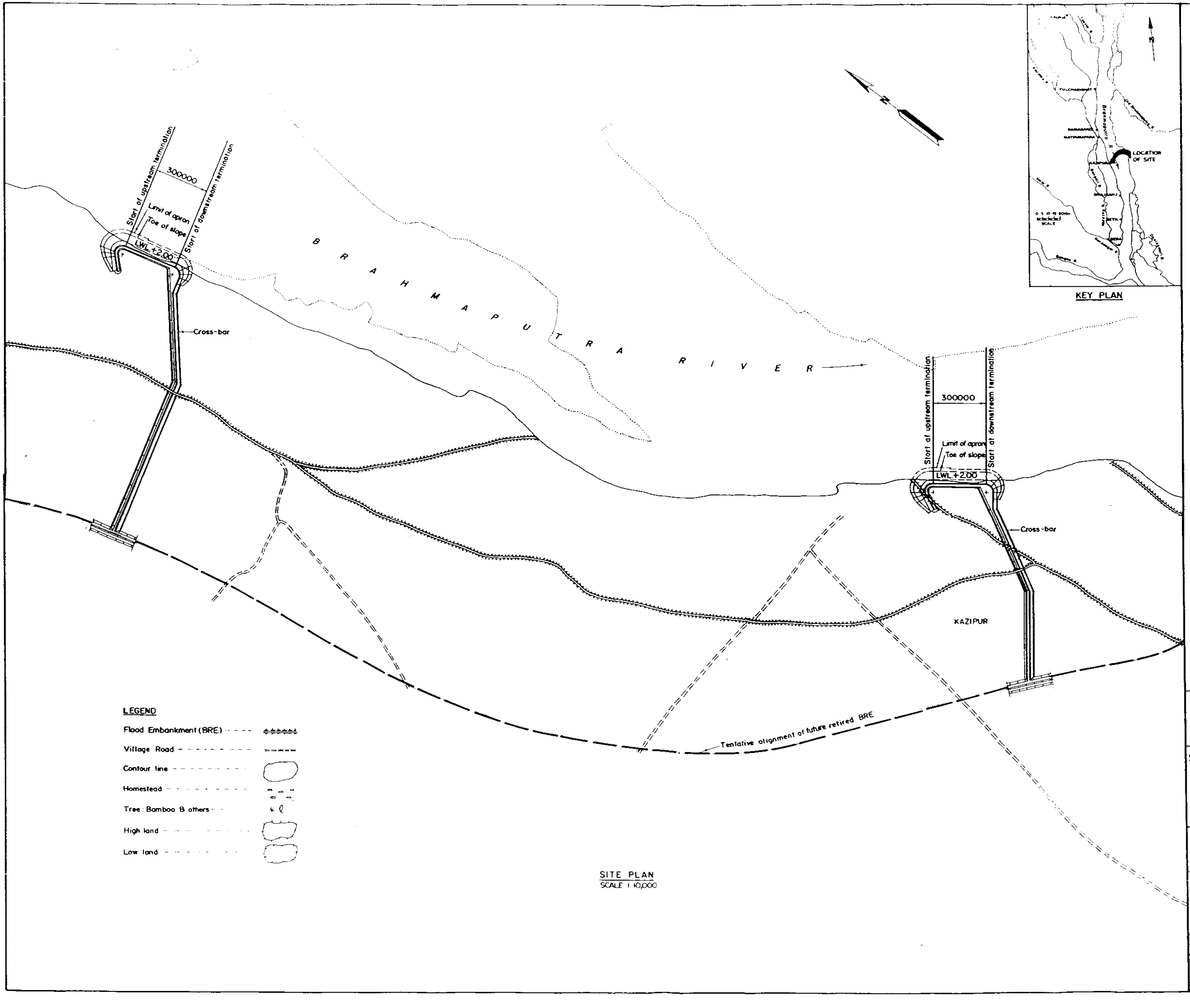
RIVER TRAINING STUDIES OF
THE BRAHMAPUTRA RIVER

CONTRACT NO.B5 : FULCHARI

LOCATION & SITE PLAN

DRAWN	CHECKED	APPROVED
TRACED	SCALE 1:10,000	DATE MAY 1995

DRAWING NO. BRT/MPR/B5/001



KEY PLAN

LEGEND

- Flood Embankment (BRE)
- Village Road
- Contour line
- Homestead
- Tree : Bamboo & others
- High land
- Low land

SITE PLAN
SCALE 1 10,000

NOTES

1. All elevations are in metres above PWD datum
2. All dimensions are in millimetres
3. Cross-bar extends to future retired position of embankment. See drawing no. BRT/MPR/B✱/007
4. Topographic information shown is based on surveys carried out in (to be completed after detailed survey)
5. For details of revetment section with access road, See drawing no. BRT/MPR/B✱/007
6. For upstream termination detail, See drawing no. BRT/MPR/B✱/005
7. For downstream termination detail, See drawing no. BRT/MPR/B✱/006
8. For typical cross-sections refer to drawing no. BRT/MPR/B✱/004
9. ✱ : insert contract number prior to tender
10. Locations of hard-points to be confirmed prior to construction.

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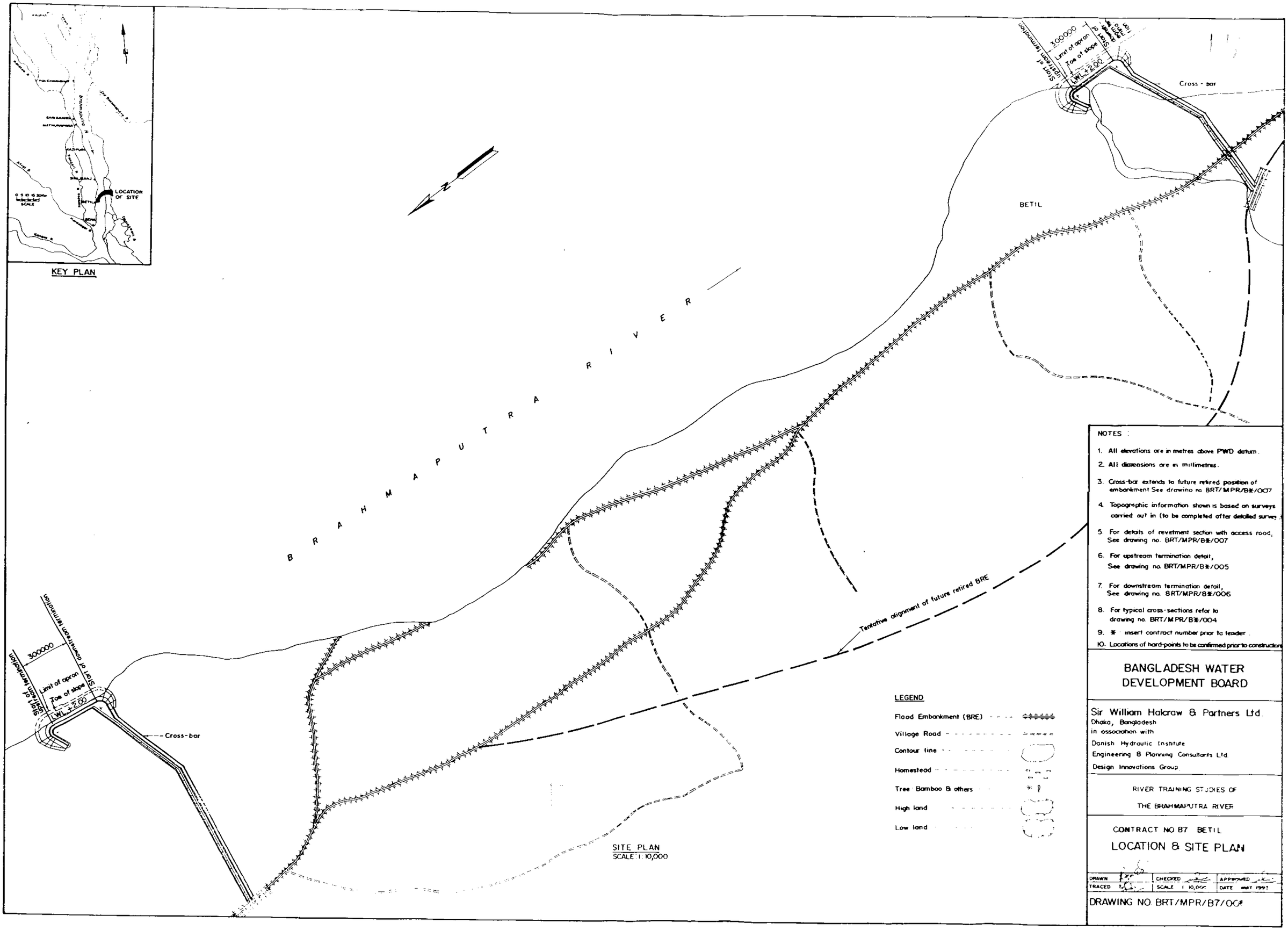
RIVER TRAINING STUDIES OF
THE BRAHMAPUTRA RIVER

CONTRACT NO.B6. KAZIPUR
LOCATION & SITE PLAN

DRAWN	CHECKED	APPROVED
TRACED	SCALE 1 10,000	DATE MAY 1995

DRAWING NO. BRT/MPR/B6/001

KEY PLAN



SITE PLAN
SCALE : 1:10,000

NOTES :

1. All elevations are in metres above PWD datum.
2. All dimensions are in millimetres.
3. Cross-bar extends to future retired position of embankment See drawing no BRT/MPR/B#/007
4. Topographic information shown is based on surveys carried out in (to be completed after detailed survey)
5. For details of revetment section with access road, See drawing no. BRT/MPR/B#/007
6. For upstream termination detail, See drawing no. BRT/MPR/B#/005
7. For downstream termination detail, See drawing no. BRT/MPR/B#/006
8. For typical cross-sections refer to drawing no. BRT/MPR/B#/004
9. # insert contract number prior to tender.
10. Locations of hard-points to be confirmed prior to construction

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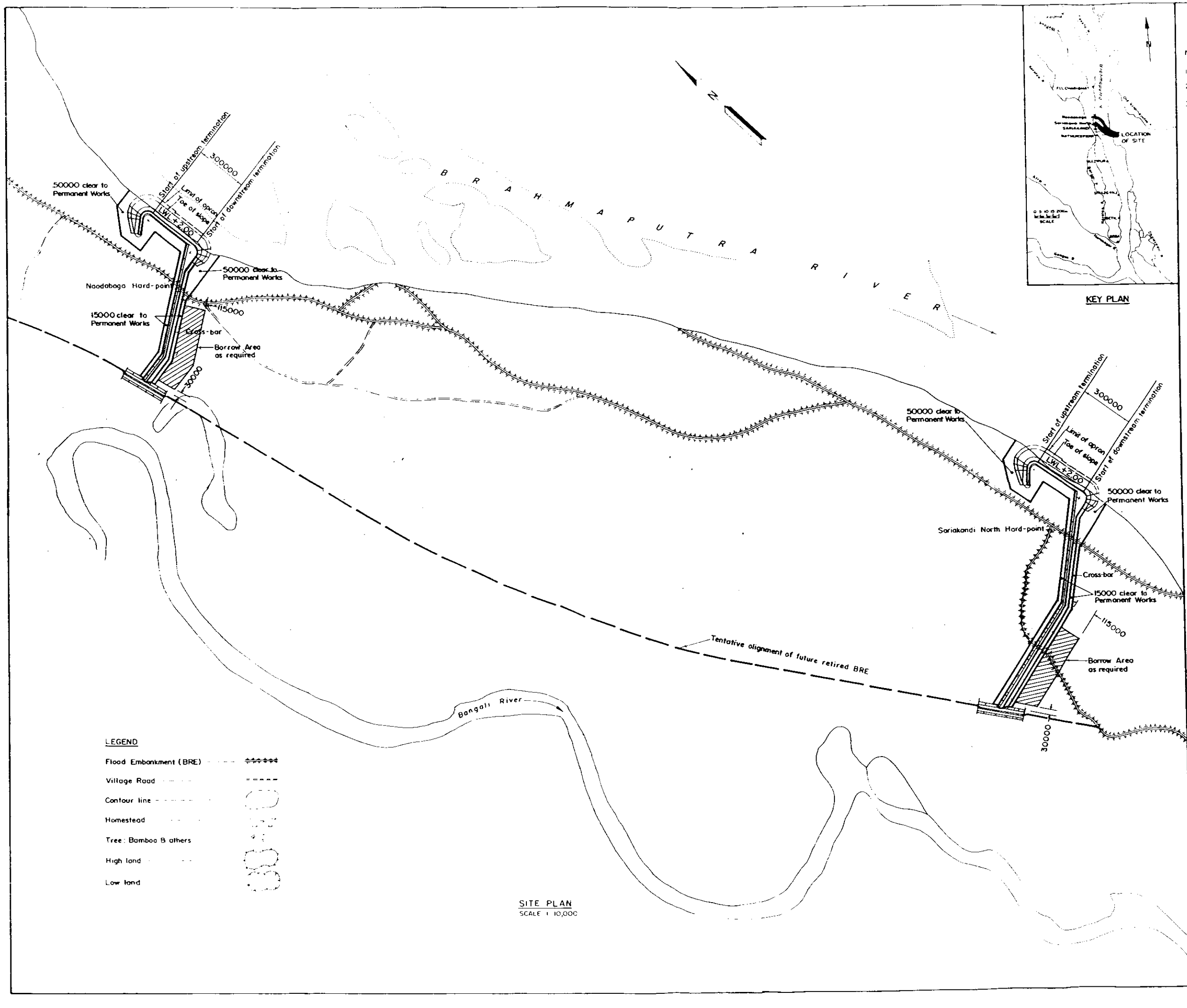
RIVER TRAINING STUDIES OF THE BRAHMAPUTRA RIVER

CONTRACT NO B7 BETIL

LOCATION & SITE PLAN

DRAWN	CHECKED	APPROVED
TRACED	SCALE 1 10,000	DATE MAY 1995

DRAWING NO. BRT/MPR/B7/00#



NOTES

1. All elevations are in metres above P.W.D. datum
2. All dimensions are in millimetres
3. Cross-bar extends to future retired position of embankment See drawing no. BRT/MPR/B#/007
4. Topographic information shown is based on surveys carried out in (to be completed after detailed survey)
5. For details of revetment section with access road, See drawing no. BRT/MPR/B#/007
6. For upstream termination detail, See drawing no BRT/MPR/B#/005
7. For downstream termination detail, See drawing no. BRT/MPR/B#/006
8. For typical cross-sections refer to drawing no. BRT/MPR/B#/004
9. # : insert contract number prior to tender
10. Locations of hard-points to be confirmed prior to construction.

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RIVER TRAINING STUDIES OF THE BRAHMAPUTRA RIVER

CONTRACT NO 23 SARIAKANDI NORTH AND NAODABAGA

WORKING AREAS

DRAWN	CHECKED	APPROVED
TRACED	SCALE 10,000	DATE May 1995

DRAWING NO. BRT/MPR/23/002

Start of upstream termination

300000

Limit of apron

Toe of slope

W.L. +2.00

Start of downstream termination

50000 clear to Permanent Works

50000 clear to Permanent Works

Approximate Bank line March 1992

SIMLA

15000 clear to Permanent Works

Cross-bar

115000

Borrow Area as required

30000

B R A H M A P U T R A R I V E R

Approximate Bank line March 1992

Tentative alignment of future retired B R E

Start of upstream termination

300000

Limit of apron

Toe of slope

W.L. +2.00

Start of D/S termination

50000 clear to Permanent Works

End of groyne

SAILABARI

60000

80000

Existing groyne incorporated in cross-bar

15000 clear to Permanent Works

LEGEND

Flood Embankment (BRE)

Village Road

Contour line

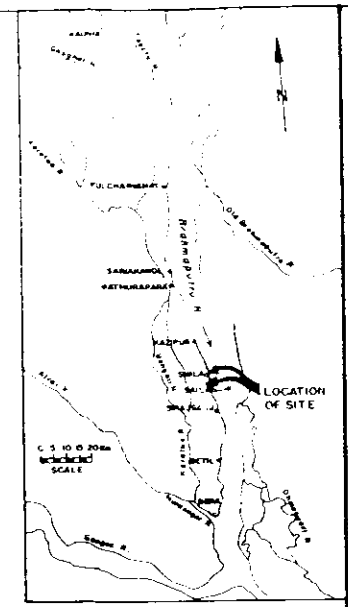
Homestead

Tree : Bamboo & others

High land

Low land

SITE PLAN
SCALE 1:10,000



KEY PLAN

NOTES

1. All elevations are in metres above PWD datum.
2. All dimensions are in millimetres
3. Cross-bar extends to future retired position of embankment See drawing no BRT/MPR/B*/007
4. Topographic information shown is based on surveys carried out in (to be completed after detailed survey
5. For details of revetment section with access road, See drawing no. BRT/MPR/B*/007
6. For upstream termination detail, See drawing no. BRT/MPR/B*/005
7. For downstream termination detail, See drawing no. BRT/MPR/B*/006
8. For typical cross-sections refer to drawing no BRT/MPR/B*/004
9. * : insert contract number prior to tender
10. Locations of hard points to be confirmed prior to construction

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RIVER TRAINING STUDIES OF THE BRAHMAPUTRA RIVER

CONTRACT NO. B4 : SAILABARI AND SIMLA

WORKING AREAS

DRAWN	CHECKED	APPROVED
TRACED	SCALE 1:10,000	DATE MAY 1993

DRAWING NO. BRT/MPR/B4/002

B R A H M A P U T R A R I V E R

FULCHARI GHAT

Start of upstream termination
300000
Start of downstream termination
Limit of apron
Toe of slope
LWL +2.00
50000 clear to Permanent Works
Approximate Bank line March 1992
50000 clear to Permanent Works
15000 clear to Permanent Works
Cross-bar
115000
Alignment of existing embankment
Borrow Area as required
30000

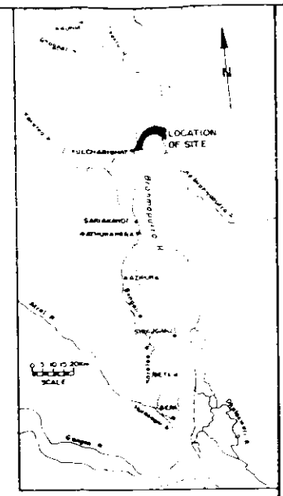
Railway line

Existing BRE

SITE PLAN
SCALE 1:10,000

LEGEND

- Flood Embankment (BRE)
- Village Road
- Contour line
- Homestead
- Tree : Bamboo & others
- High land
- Low land



KEY PLAN

NOTES

1. All elevations are in metres above PWD datum
2. All dimensions are in millimetres
3. Cross-bar extends to future raised position of embankment See drawing no BRT/MPR/B*/007
4. Topographic information shown is based on surveys carried out in (to be completed after detailed survey)
5. For details of revetment section with access road, See drawing no BRT/MPR/B*/007
6. For upstream termination detail, See drawing no BRT/MPR/B*/005
7. For downstream termination detail, See drawing no BRT/MPR/B*/006
8. For typical cross-sections refer to drawing no BRT/MPR/B*/004
9. * insert contract number prior to tender
10. Locations of hard-points to be confirmed prior to construction

BANGLADESH WATER DEVELOPMENT BOARD

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Design Innovations Group

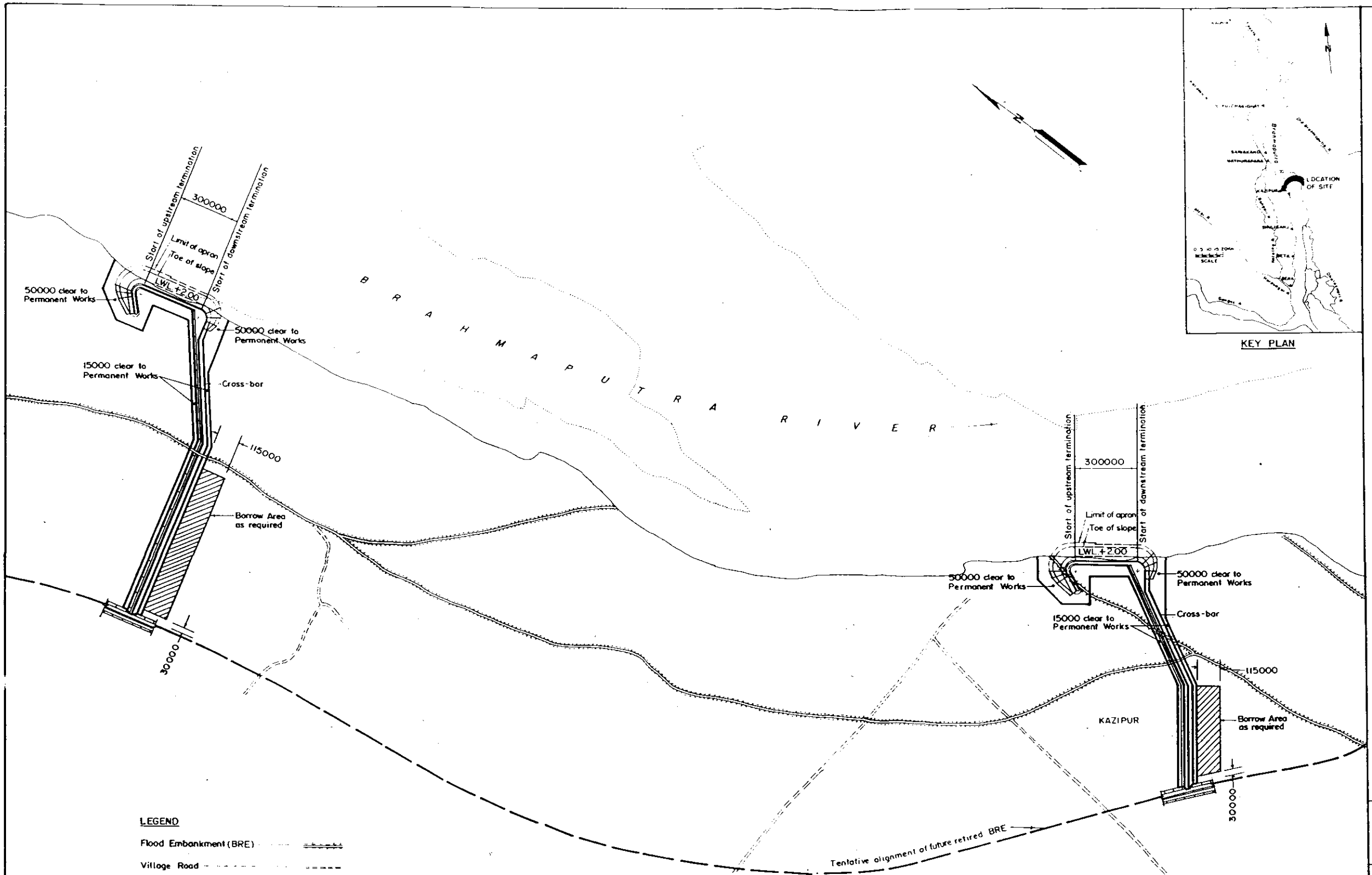
RIVER TRAINING STUDIES OF THE BRAHMAPUTRA RIVER

CONTRACT NO. B5 : FULCHARI

WORKING AREAS

DRAWN CHECKED APPROVED
TRACED SCALE 1:10,000 DATE MAY 1992

DRAWING NO. BRT/MPR/B5/002



LEGEND

- Flood Embankment (BRE)
- Village Road
- Contour line
- Homestead
- Tree : Bamboo & others
- High land
- Low land

SITE PLAN
SCALE 1:10,000

KEY PLAN

NOTES

1. All elevations are in metres above PWD datum
2. All dimensions are in millimetres
3. Cross-bar extends to future retired position of embankment. See drawing no. BRT/MPR/B※/007
4. Topographic information shown is based on surveys carried out in (to be completed after detailed survey)
5. For details of revetment section with access road, See drawing no. BRT/MPR/B※/007
6. For upstream termination detail, See drawing no. BRT/MPR/B※/005
7. For downstream termination detail, See drawing no. BRT/MPR/B※/006
8. For typical cross-sections refer to drawing no. BRT/MPR/B※/004
9. ※ insert contract number prior to tender
10. Locations of hard-points to be confirmed prior to construction

BANGLADESH WATER DEVELOPMENT BOARD

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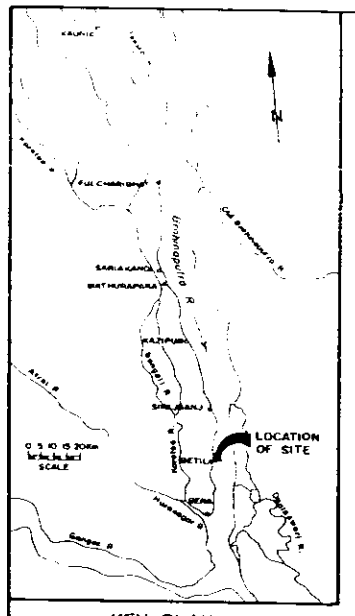
Design Innovations Group

RIVER TRAINING STUDIES OF
THE BRAHMAPUTRA RIVER

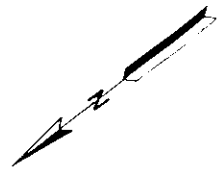
CONTRACT NO. B6. KAZIPUR
WORKING AREAS

DRAWN	CHECKED	APPROVED
TRACED	SCALE 10,000	DATE MAY 1993

DRAWING NO BRT/MPR/86/002

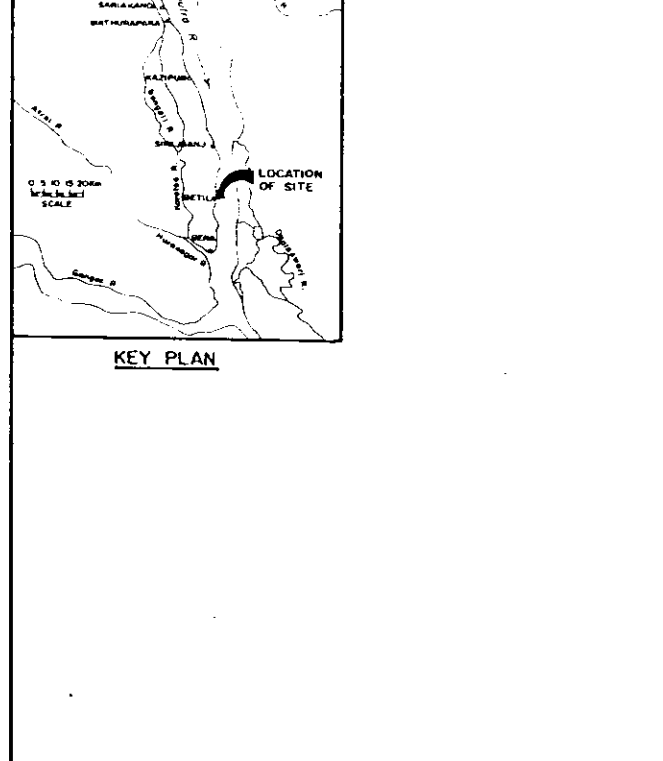


KEY PLAN

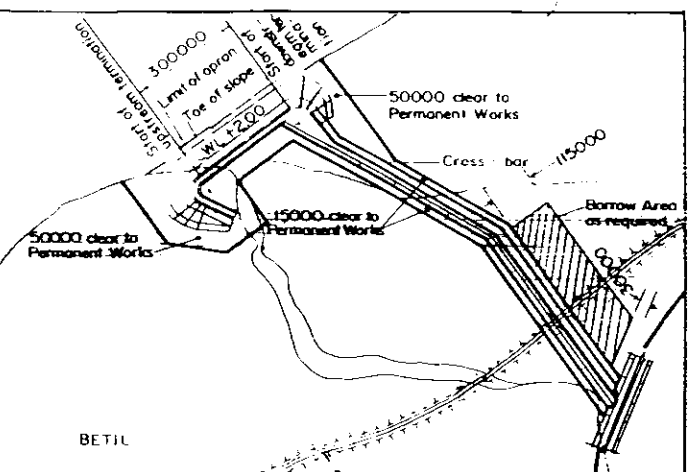


B R A H M A P U T R A R I V E R

BETIL



SITE PLAN
SCALE 1 10,000



Tentative alignment of future retired BRE

LEGEND

- Flood Embankment (BRE)
- Village Road
- Contour line
- Homestead
- Tree Bamboo & others
- High land
- Low land

NOTES :

1. All elevations are in metres above PWD datum
2. All dimensions are in millimetres
3. Cross-bar extends to future retired position of embankment. See drawing no BRT/MPPR/B*/007
4. Topographic information shown is based on surveys carried out in (to be completed after detailed survey)
5. For details of revetment section with access road. See drawing no BRT/MPPR/B*/007
6. For upstream termination detail, See drawing no BRT/MPPR/B*/005
7. For downstream termination detail See drawing no BRT/MPPR/B*/006
8. For typical cross sections refer to drawing no BRT/MPPR/B*/004
9. * insert contract number prior to tender
10. Locations of hard points to be confirmed prior to construction

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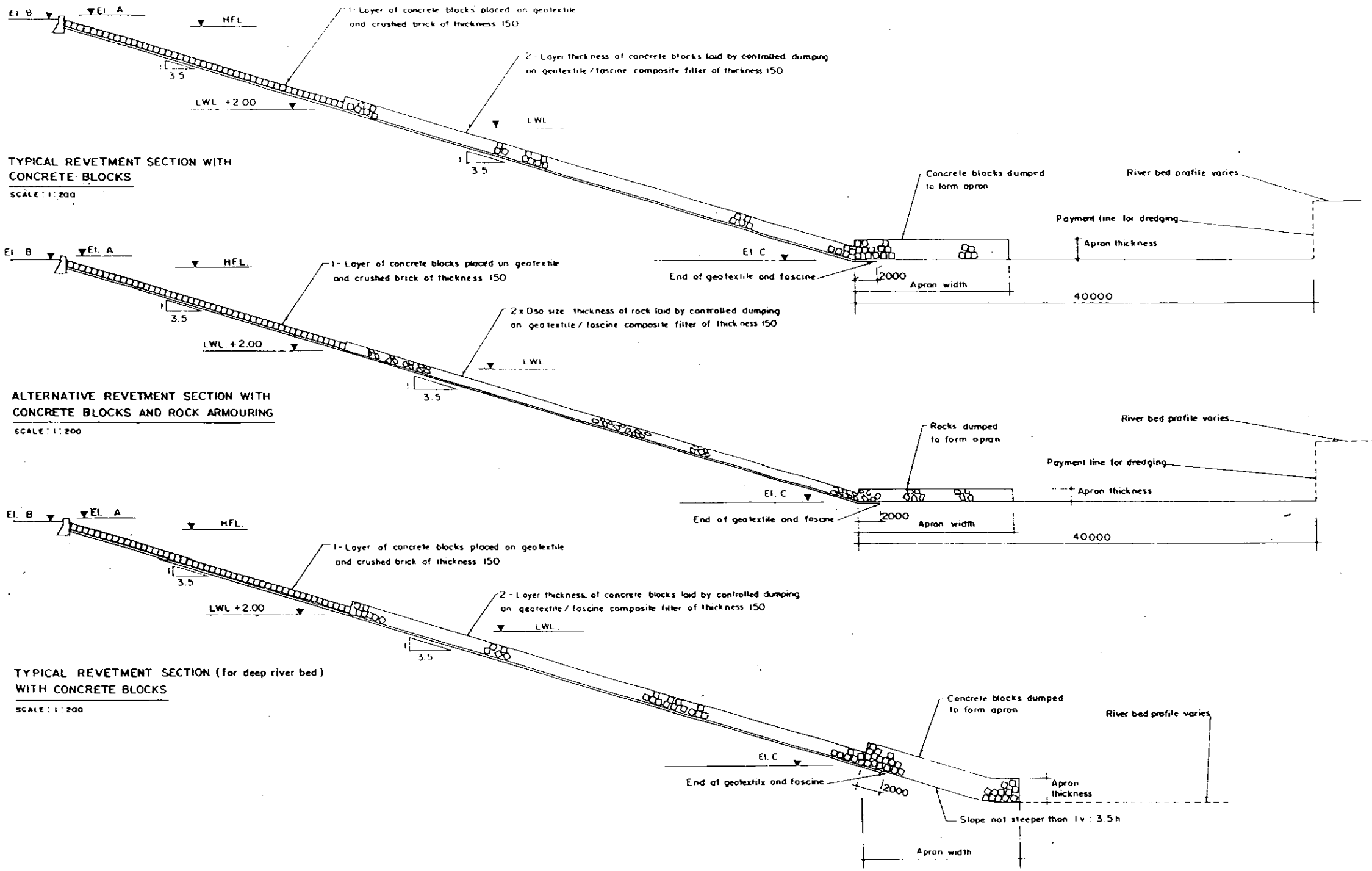
RIVER TRAINING STUDIES OF THE BRAHMAPUTRA RIVER

CONTRACT NO BT BE

WORKING AREAS

DRAWN CHECKED APPROVED
TRACED SCALE DATE

DRAWING NO BRT/MPPR/BT 002



STRUCTURE	ARMOURING					APRON WIDTH	APRON THICKNESS	
	CONCRETE BLOCKS SIZE (D)		QUARRY ROCK					
	BRICK AGG.	STONE AGG.	Nominal D50	Nominal Min. Wt (kg)	Nominal Max. Wt.(kg)		BLOCKS	ROCK
Upstream Termination	720	550	450	140	425	20500	4.50	4.50_{SG}
Downstream Termination / Straight revetment	550	450	320	50	150	14500	3.50	3.50_{SG}

CONTRACT NO.	LOCATION		El. A	El. B	El. C	HFL	LWL
B3	Soriakandi North		20.90	20.55	0.56	19.90	11.50
	Naodaboga		21.20	20.85	0.86	20.20	11.74
B4	Sailabari		17.00	16.65	-3.34	16.00	7.26
	Simla		17.30	16.95	-3.04	16.30	7.88
B5	Fulchorighat	D/S	22.60	22.25	2.26	21.60	13.00
		U/S	22.80	22.45	2.46	21.80	13.23
B6	Kazipur	D/S	18.50	18.15	-1.84	17.50	9.57
		U/S	19.00	18.65	-1.34	18.00	10.07
B7	Betil	D/S	14.20	13.85	-6.14	13.50	5.03
		U/S	14.70	14.35	-5.64	14.00	5.53

NOTES

1. All elevations are in metres above PWD datum
2. All dimensions are in millimetres
3. Respective levels represent the following
   - El. A : Retaining wall crest level
   - El. B : Access road level
   - El. C : Apron setting level
   - HFL : 1 in 100 yr. High Flood Level
   - LWL : 1 in 2yr. Low Water Level
4. Concrete blocks to be class B
5. River bed profile to be added to cross-sections prior to formal issue of Tender Drawings according to latest survey data.
6. D/S means Downstream hard-point
7. U/S means Upstream hard-point
8. ✱ : this drawing is common to all Phase 1B and Phase 1C contracts. Insert contract details prior to issue.

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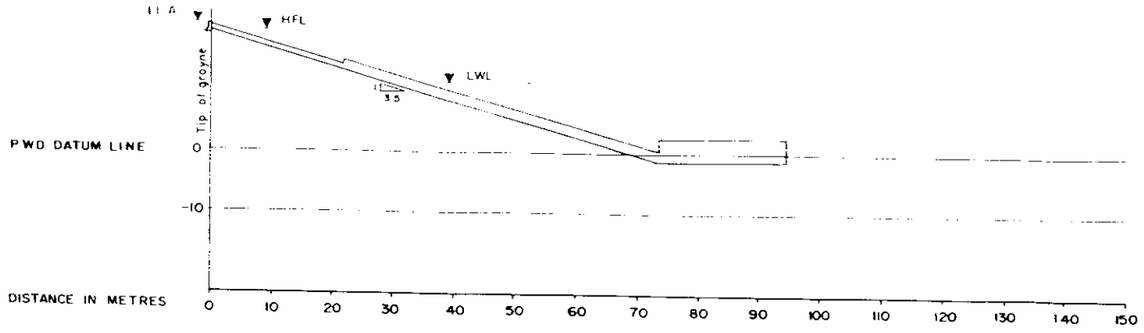
RIVER TRAINING STUDIES OF THE BRAHMAPUTRA RIVER

CONTRACT NO. B ✱

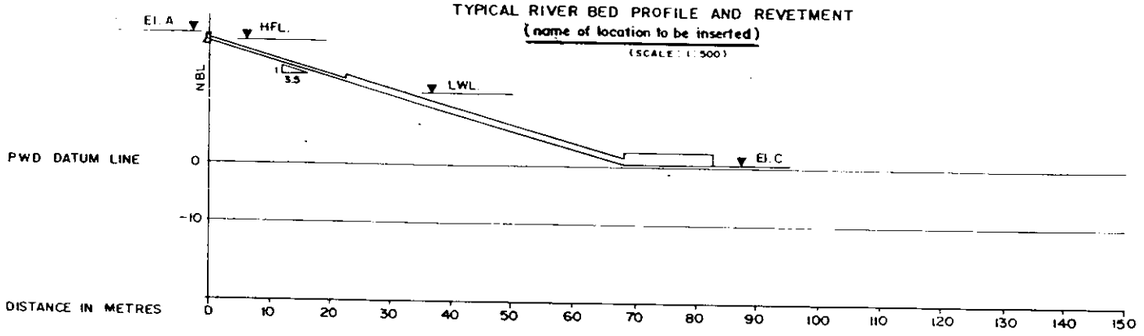
TYPICAL SECTIONS

DRAWN: R. Akram | CHECKED: | APPROVED:
TRACED: O.A | SCALE: 1:200 | DATE: MAY 1995

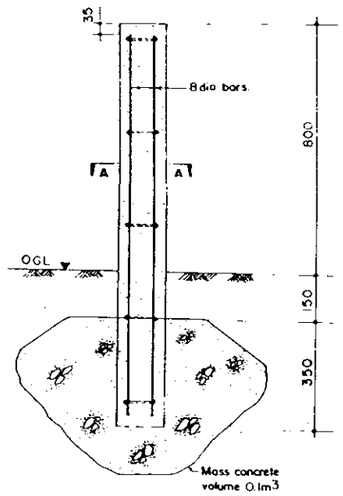
DRAWING NO BRT/MPR/B✱/003



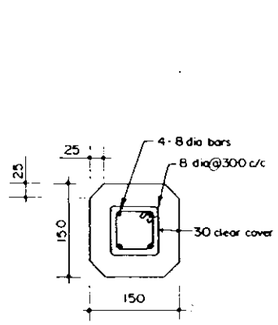
TYPICAL RIVER BED PROFILE AND REVETMENT
(name of location to be inserted)
(SCALE : 1 : 500)



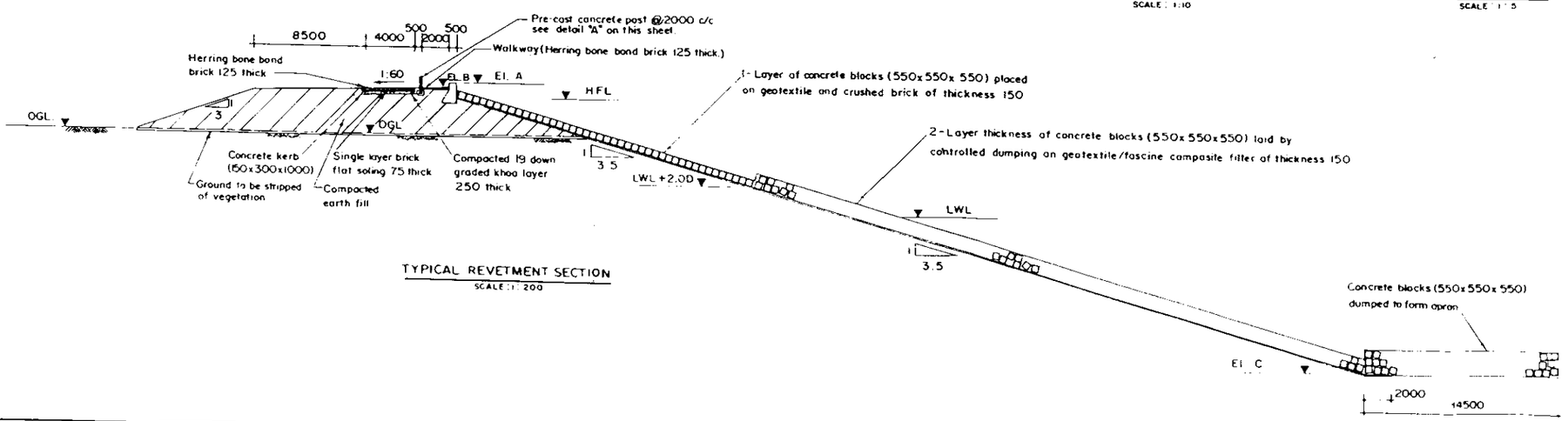
TYPICAL RIVER BED PROFILE AND REVETMENT
(name of location to be inserted)
(SCALE : 1 : 500)



DETAIL A
SCALE : 1:10



SECTION A-A
SCALE : 1 : 5



TYPICAL REVETMENT SECTION
SCALE : 1 : 200

NOTES

1. All elevations are in metres above PWD datum
2. All dimensions are in millimetres
3. NBL means Nominal Bank Line
4. River bed information shown in section is based on bathymetric survey of (to be completed after detail survey)
5. Precast concrete post to be class A2 with foundation mass concrete class C1
6. For details of elevations and water levels, see Drg. no. BRT/MPR/B✱/003
7. HFL means 1:100 yr. High Flood Level.
8. LWL means 1:2 yr. Low Water Level.
9. OGL means Original Ground Level.
10. River bed profile to be added to cross-sections ipriar to formal issue of Tender Drawings according to latest survey data.
11. ✱ : this drawing is common to allPhase 1B and Phase 1C contracts. Insert contract details prior to issue.

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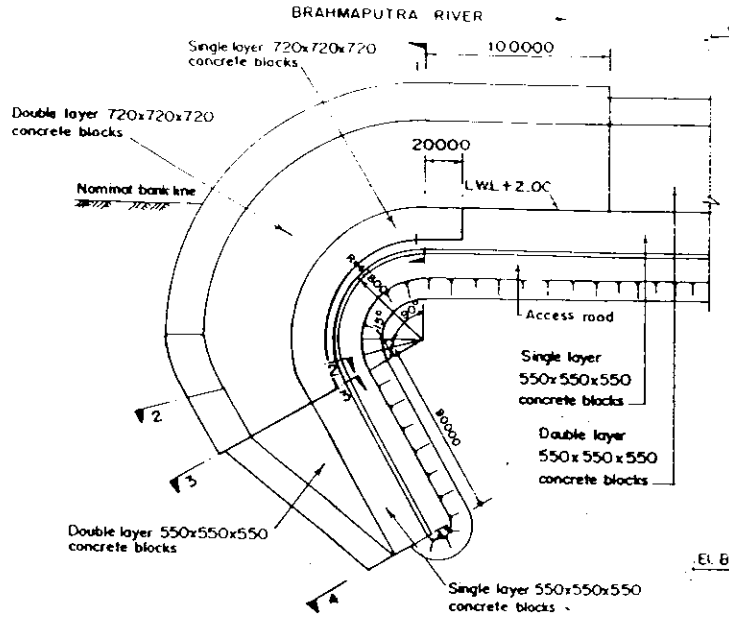
RIVER TRAINING STUDIES OF THE BRAHMAPUTRA RIVER

CONTRACT NO. B ✱

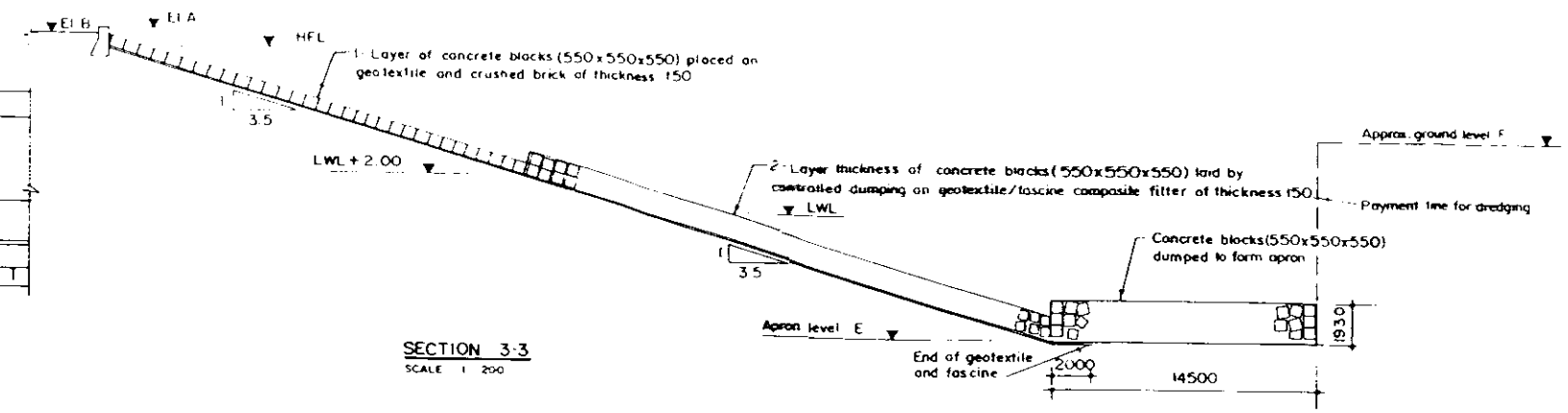
REVETMENT CROSS-SECTIONS

DRAWN R Ahsan	CHECKED	APPROVED
TRACED D A	SCALE As shown	DATE MAY 1995

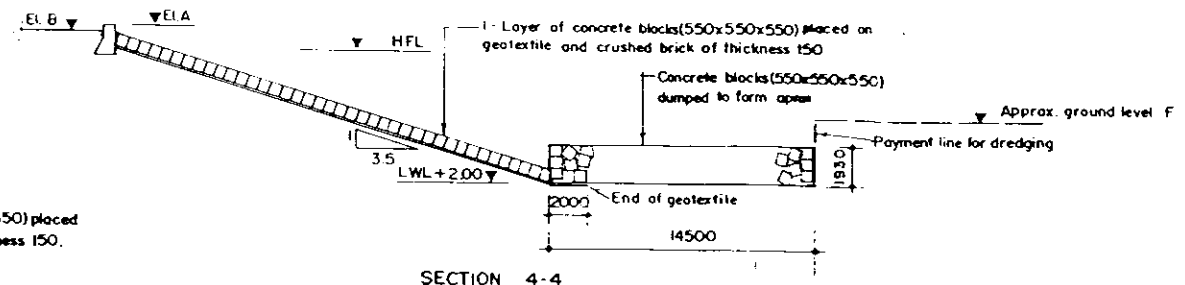
DRAWING NO. BRT/MPR/B✱/004



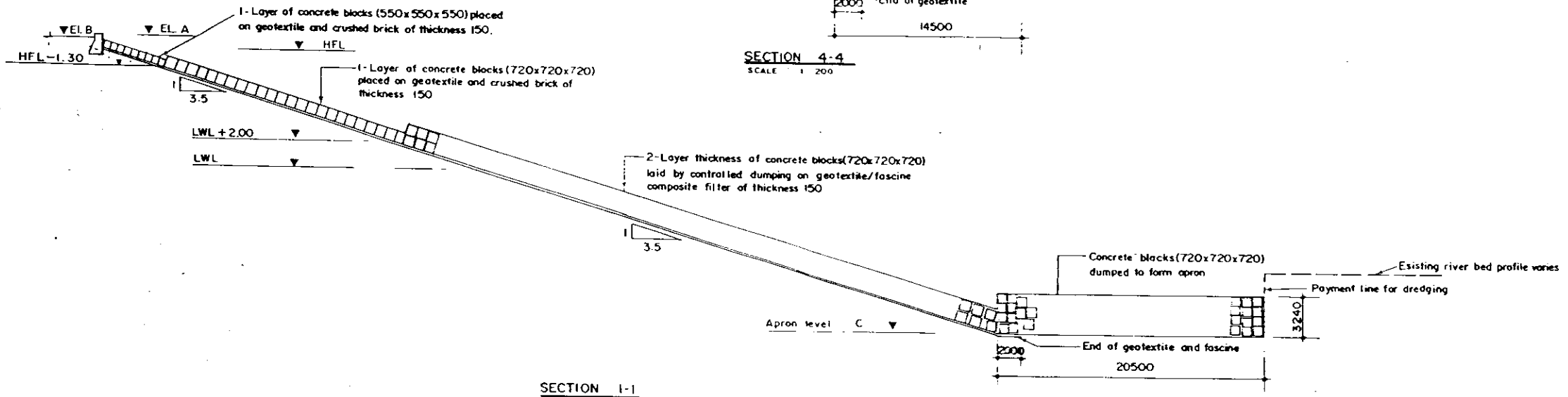
PLAN OF UPSTREAM TERMINATION
SCALE : 1 : 2000



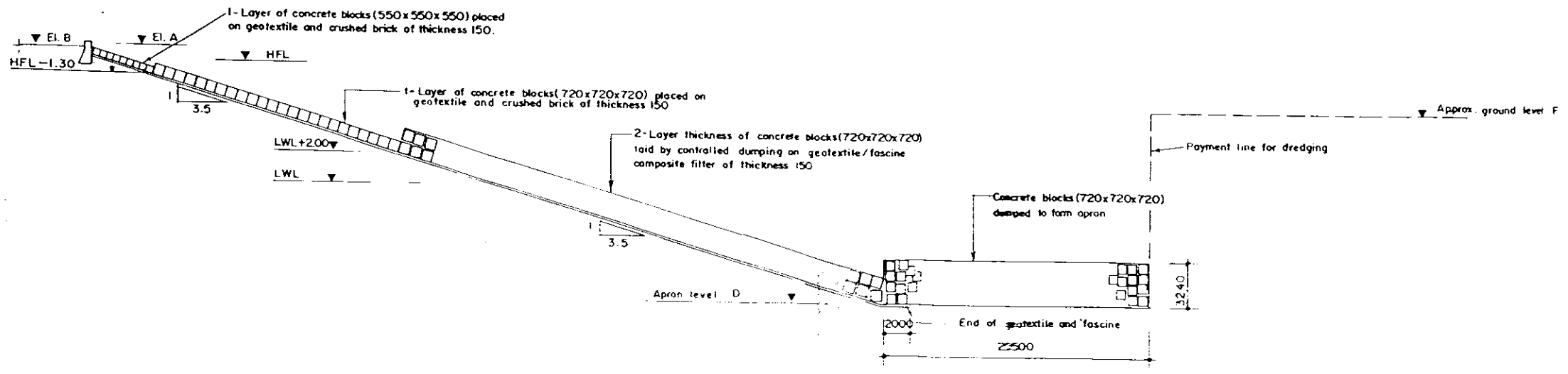
SECTION 3-3
SCALE 1 200



SECTION 4-4
SCALE 1 200



SECTION 1-1
SCALE 1 200



SECTION 2-2
SCALE 1 200

NOTES :

1. All elevations are in metres above PWD datum
2. All dimensions are in millimetres
3. Termination to be backfilled to original ground level on country side of nominal bank line.
4. Elevations and water levels are on Drawing No BRT/MPR/B*/003 except El. D, E, E and level F.
5. El. D = El. C + 2.6m.
6. El. E = El. C + 5.2m.
7. Level F to be completed following updated survey.
8. * : this drawing is common to all Phase 1E and Phase 1C contracts. Insert contract details prior to issue.

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RIVER TRAINING STRUCTURES OF THE BRAHMAPUTRA RIVER

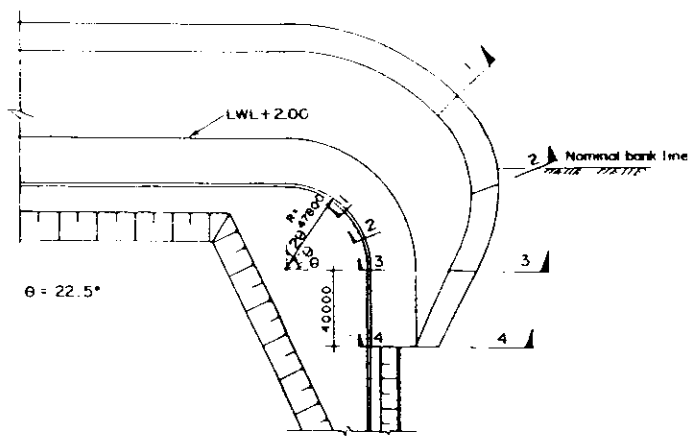
CONTRACT NO. B *

DETAILS OF UPSTREAM TERMINATION

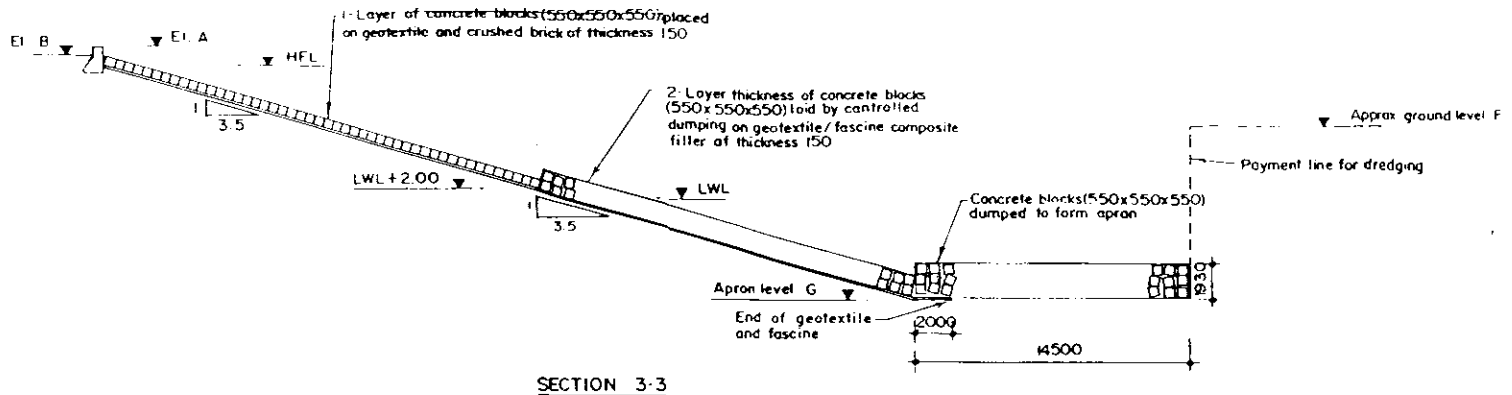
DRAWN R. Akram	CHECKED	APPROVED
TRACED MONIR	SCALE 1:200, F 1:2000	DATE MAY 1993

DRAWING NO. BRT/MPR/B*/005

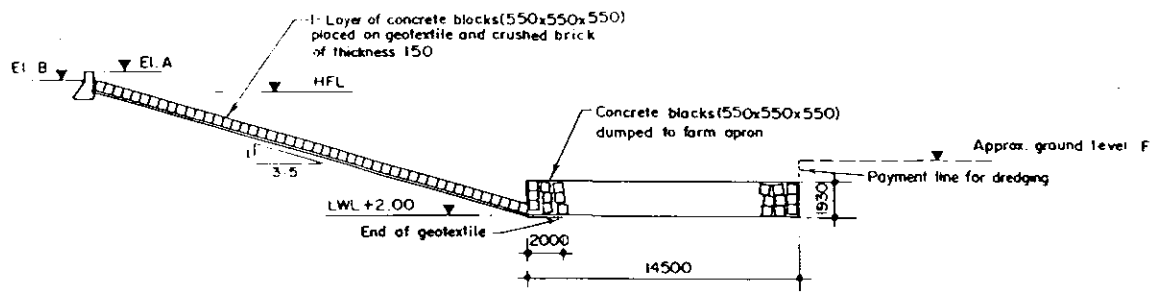
BRAHMAPUTRA RIVER



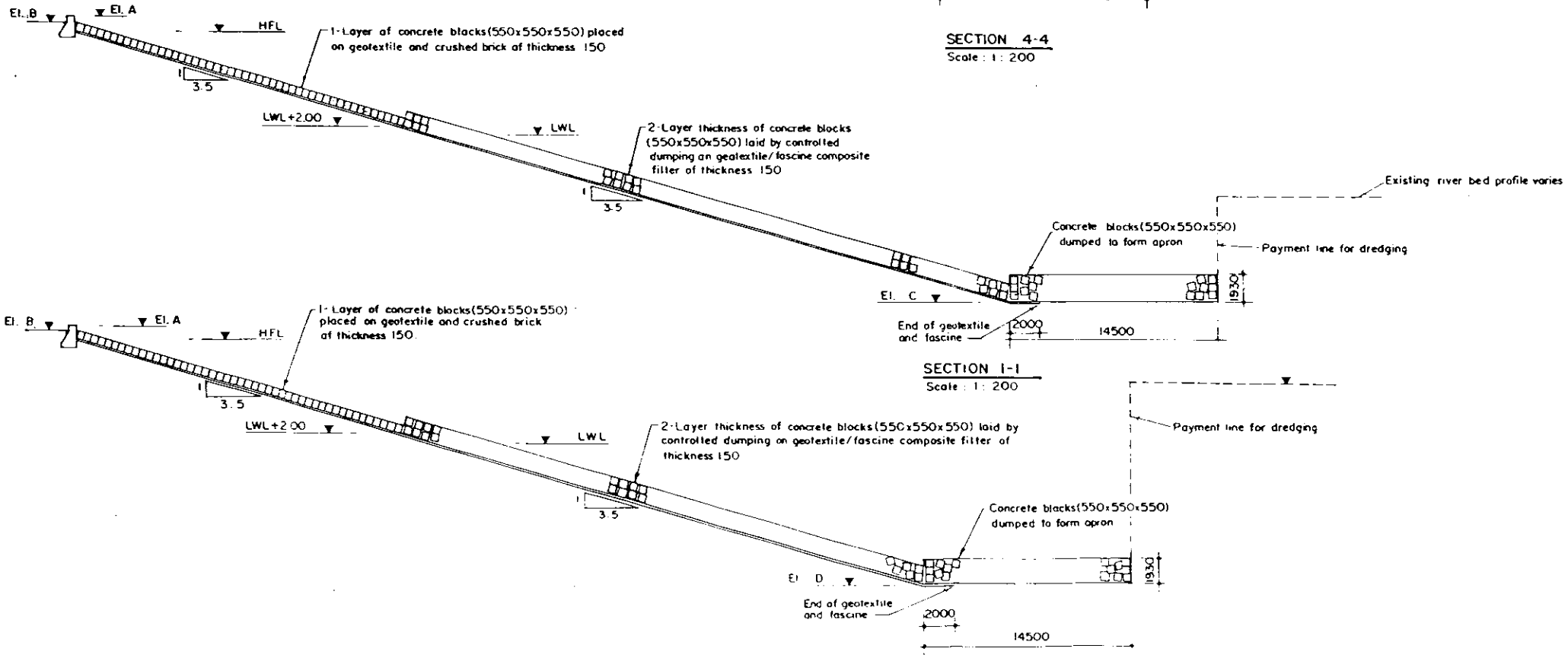
PLAN OF DOWNSTREAM TERMINATION
Scale : 1 : 2000



SECTION 3-3
Scale : 1 : 200



SECTION 4-4
Scale : 1 : 200



SECTION 1-1
Scale : 1 : 200

SECTION 2-2
Scale : 1 : 200

NOTES

1. All elevations are in metres above PWD datum
2. All dimensions are in millimetres
3. Termination to be backfilled to original ground level on country side of nominal bank line
4. Elevations and water levels are on Drawing No. BRT/MPR/B&C/003 except El D, El G and level F
5. El. D = El. C + 2.60m.
6. El. G = El. C + 7.22m
7. Level F to be completed following updated survey.
8. ✱ : this drawing is common to all Phase 1B and Phase 1C contracts. Insert contract details prior to issue.

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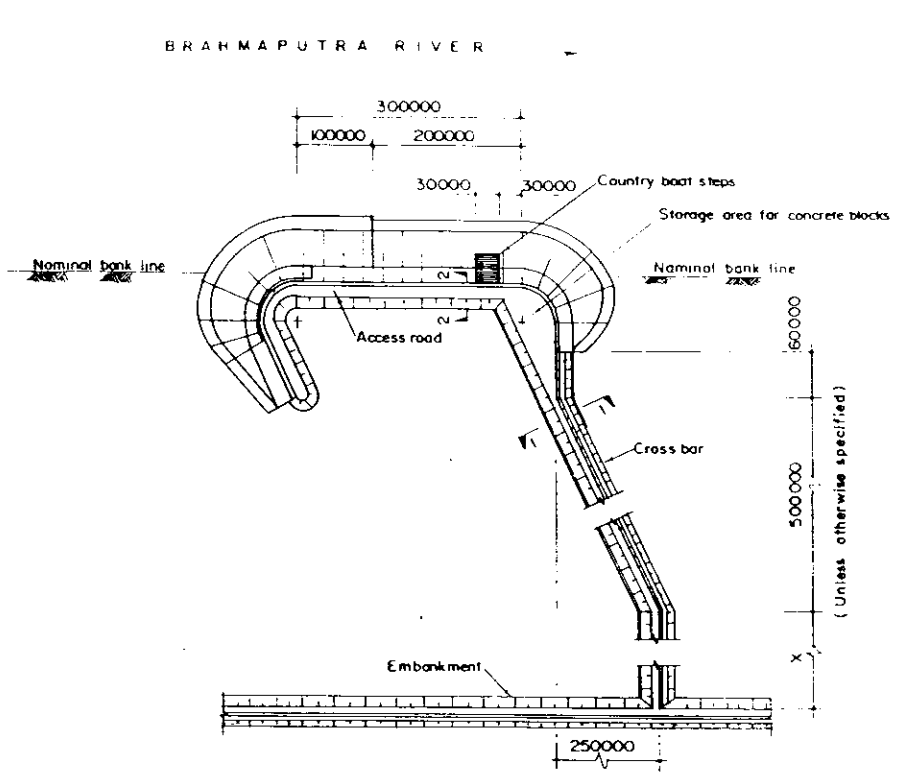
RIVER TRAINING STUDIES OF THE BRAHMAPUTRA RIVER

CONTRACT NO. B ✱

DETAILS OF DOWNSTREAM TERMINATION

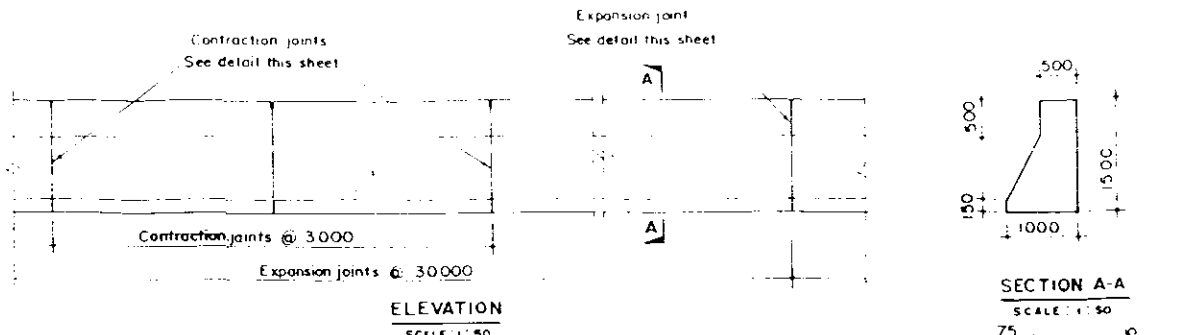
DRAWN R Ahsan | CHECKED | APPROVED
TRACED WONG | SCALE 1:200, 1:2000 | DATE MAY 1993

DRAWING NO. BRT/MPR/B✱/005



PLAN OF TYPICAL BANK REVETMENT & CROSS-BAR

SCALE : 1:5000

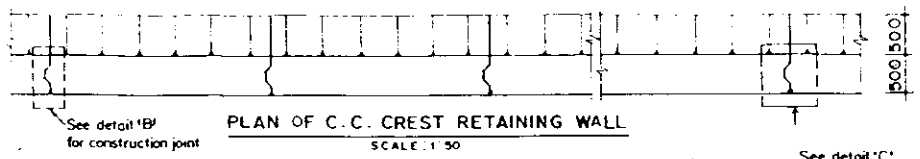


ELEVATION

SCALE : 1:50

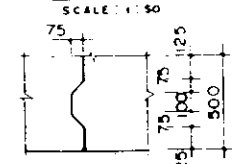
SECTION A-A

SCALE : 1:50



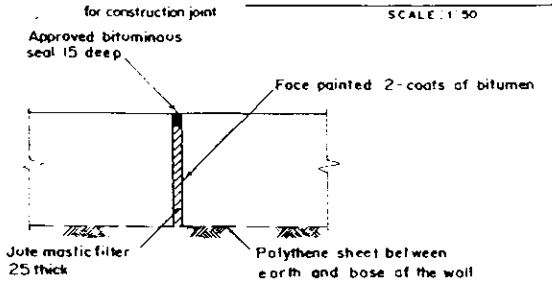
PLAN OF C.C. CREST RETAINING WALL

SCALE : 1:50



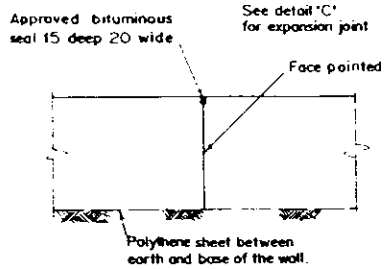
DETAIL-'B'

SCALE : 1:20



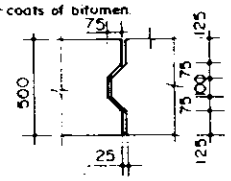
TYPICAL EXPANSION JOINT DETAIL

SCALE : 1:50



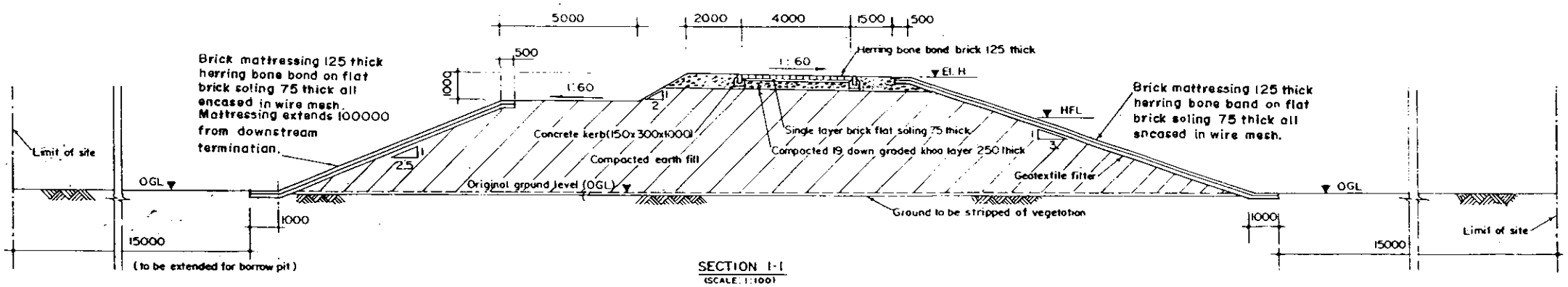
TYPICAL CONTRACTION JOINT DETAIL

SCALE : 1:50



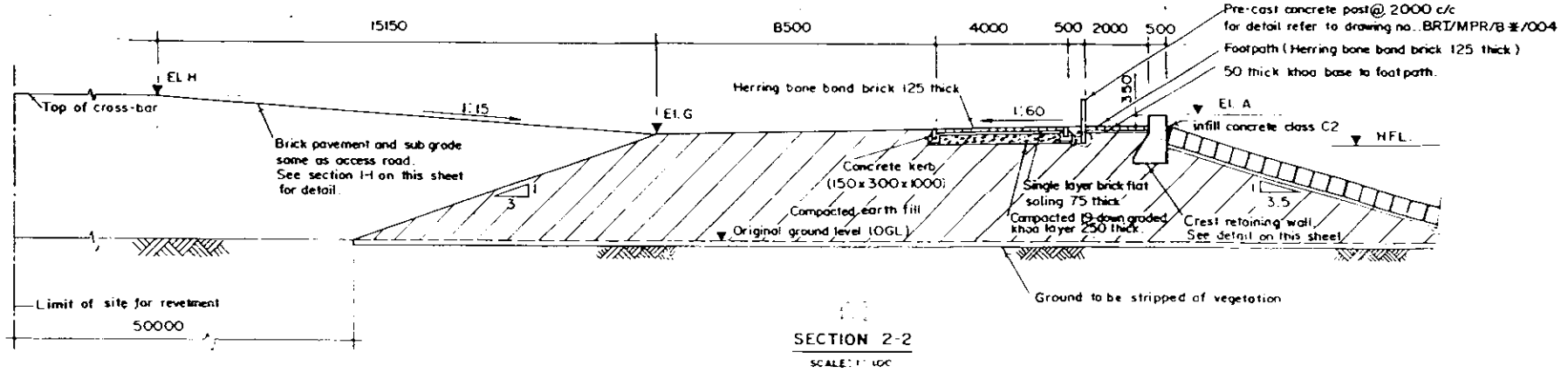
DETAIL-C

SCALE : 1:20



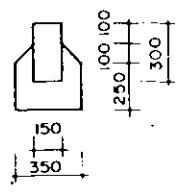
SECTION 1-1

(SCALE: 1:100)



SECTION 2-2

SCALE: 1" 100'



DETAIL OF KERB

SCALE : 1:20

NOTES

1. All elevations are in metres above PWD datum.
2. All dimensions are in millimetres.
3. For locations of revetments refer to Drawing no. BRT/MPR/B✱/001
4. Crest retaining wall may be precast subject to Engineers approval of method.
5. Fair face on retaining wall to extend 150 below surface of ground or infill concrete.
6. For details of country boat steps refer to Drawing no. BRT/MPR/B✱/009
7. Where required for cross-bar construction, borrow pits may be opened on the downstream side, not closer than 30000 and not deeper than 2000. Plan dimensions and spacing to be determined by the Engineer.
8. Dimension X : To be determined by the Engineer.
9. Elevations and water levels are on Drawing No. BRT/MPR/B✱/003 except El G, El H and OGL.
10. El. G : El. A - 0.60m.
11. El. H : El. A + 0.50m.
12. O.G.L : Original ground level.
13. Crest retaining wall to be concrete class 'A1'.
14. ✱ : this drawing is common to all Phase 1B and Phase 1C contracts. Insert contract details prior to issue.

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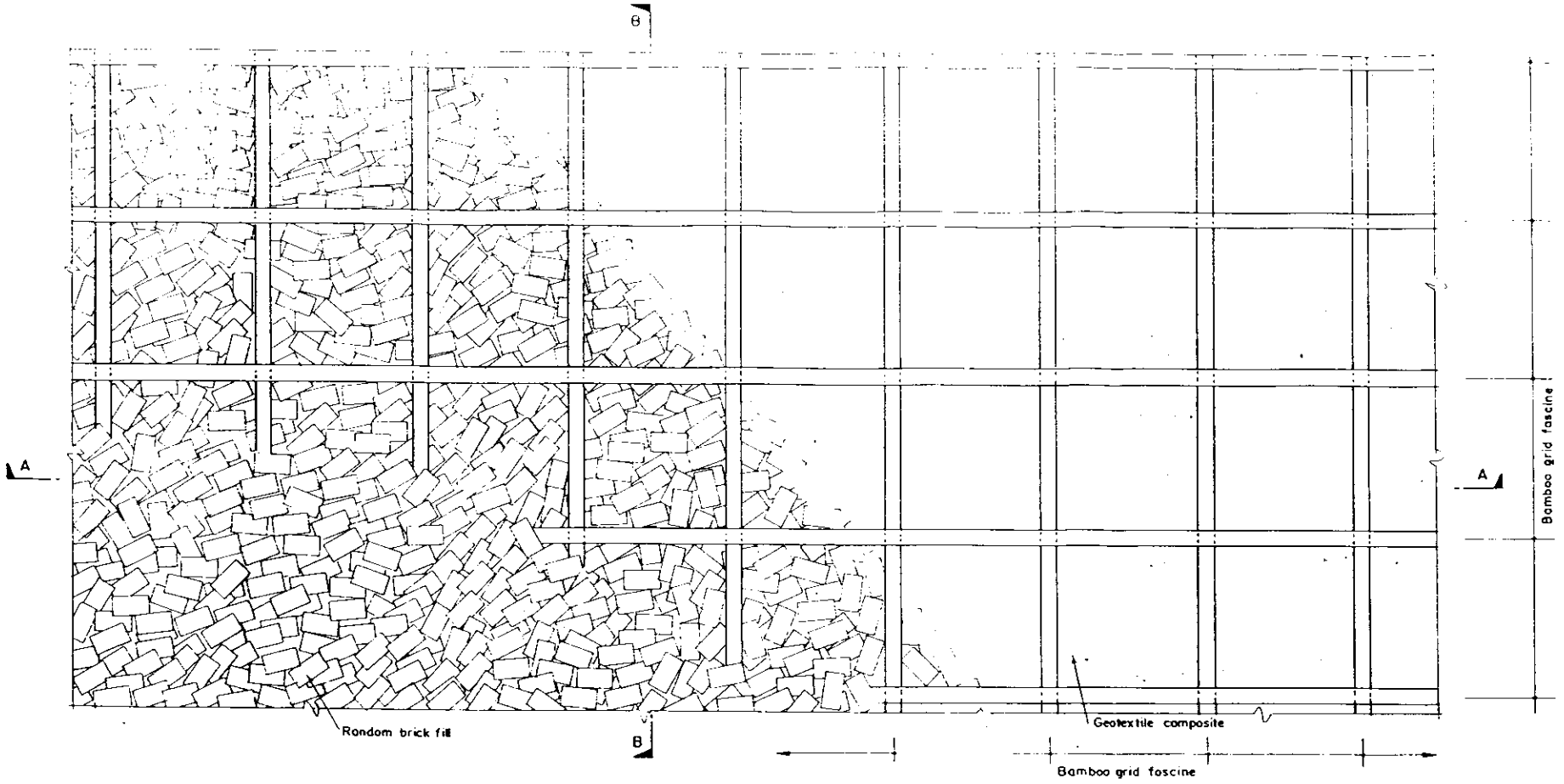
RIVER TRAINING STUDIES OF THE BRAHMAPUTRA RIVER

CONTRACT NO. B ✱

DETAILS OF
TYPICAL CROSS-BAR & ACCESS ROAD

DRAWN : R. AHSAN	CHECKED :	APPROVED :
TRACED : O. A	SCALE : AS SHOWN	DATE : MAY 1993

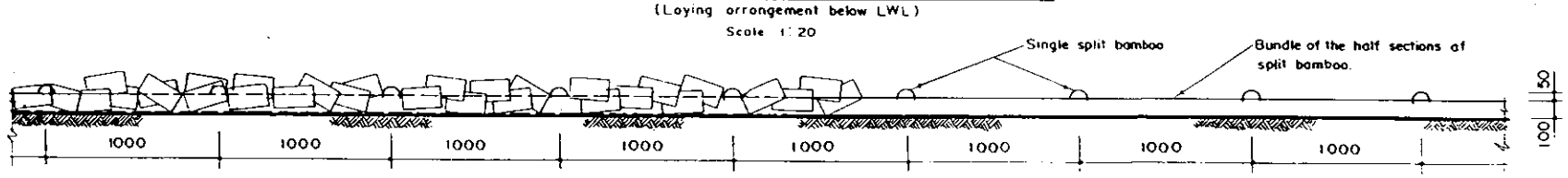
DRAWING NO. BRT/MPR/B✱/007



TYPICAL GEOTEXTILE/FASCINE FOR COMPOSITE FILTER

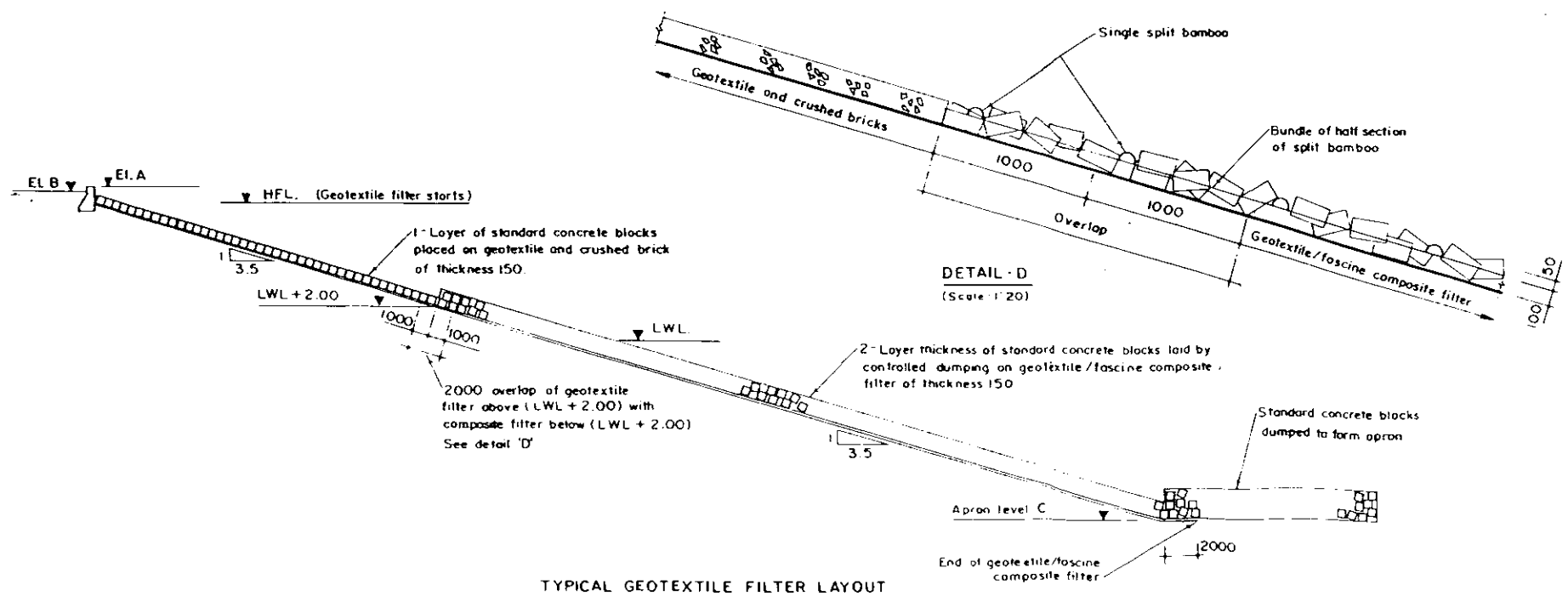
(Laying arrangement below LWL)

Scale 1:20



SECTION A-A

(Scale 1:20)

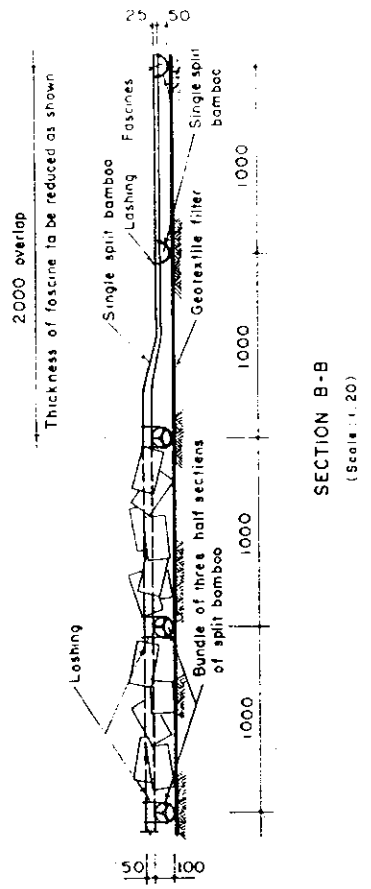


TYPICAL GEOTEXTILE FILTER LAYOUT

(Scale 1:200)

DETAIL-D

(Scale 1:20)



SECTION B-B

(Scale 1:20)

NOTES:

1. All dimensions are in millimetres
2. All elevations are in metres above PWD datum
3. Elevations and water levels are on Drawing No. BRT/MPR/B*/003
4. * : this drawing is common to all Phase 1B and Phase 1C contracts. Insert contract details prior to issue.

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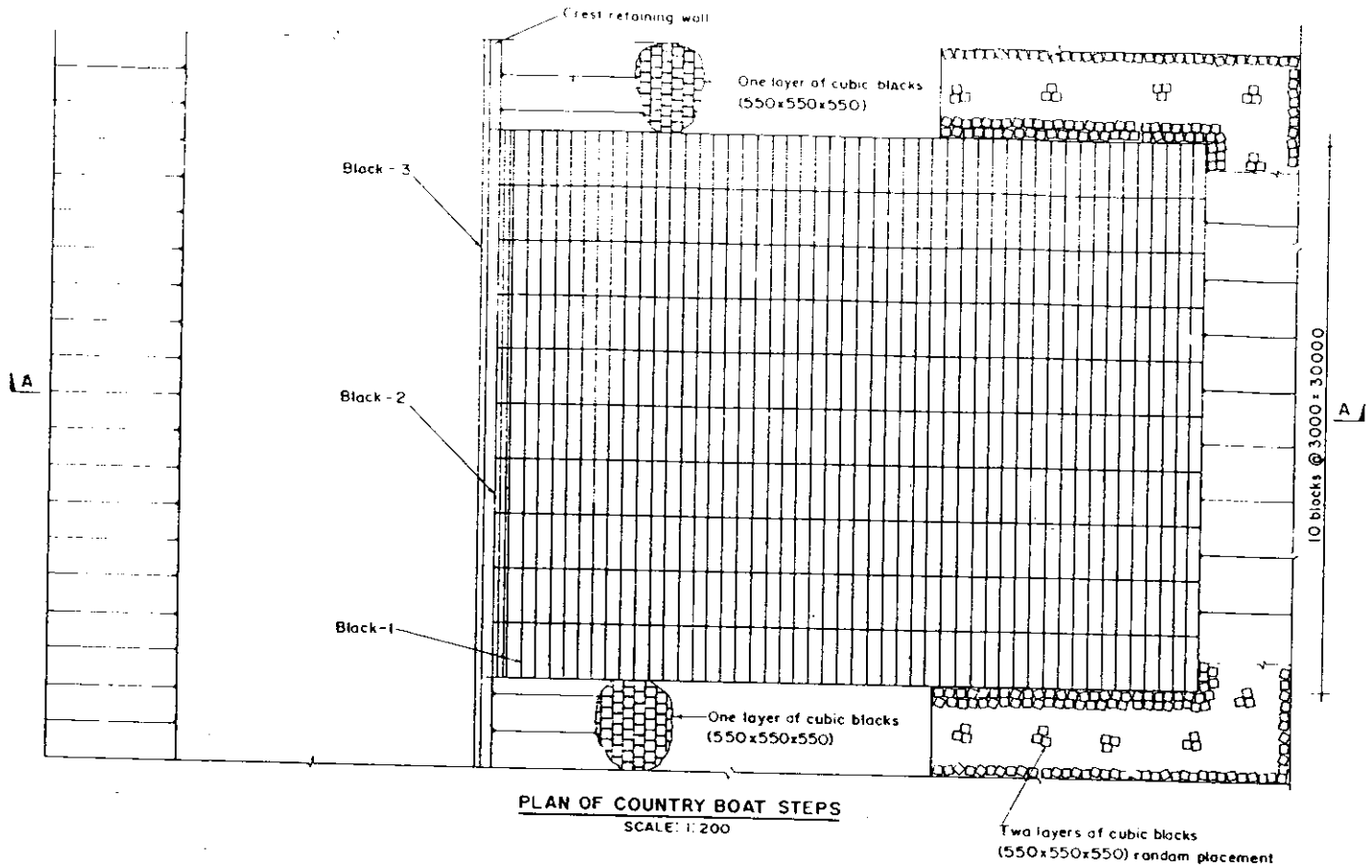
RIVER TRAINING STUDIES OF THE BRAHMAPUTRA RIVER

CONTRACT NO. B *

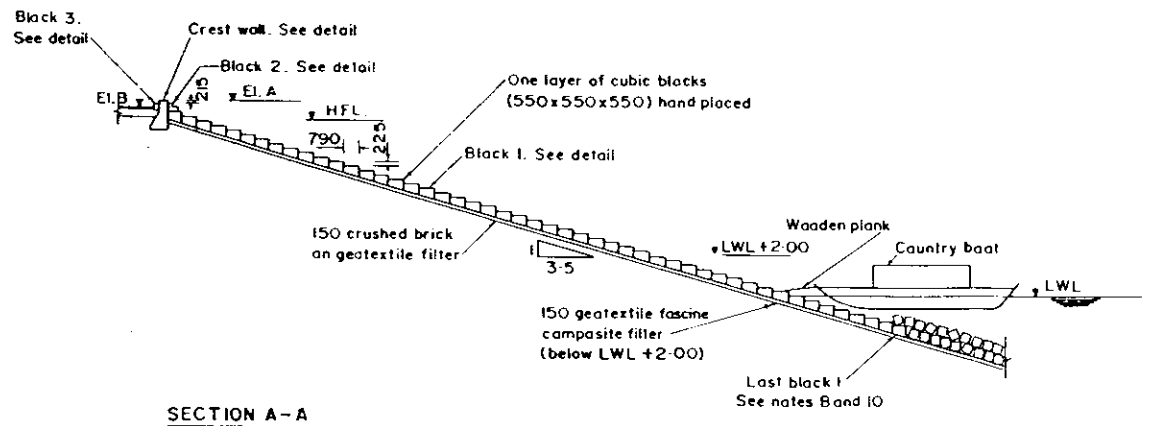
TYPICAL GEOTEXTILE FILTER ARRANGEMENT

DRAWN	CHECKED	APPROVED
TRACED	SCALE : 1:20 / 200	DATE : MAY 1993

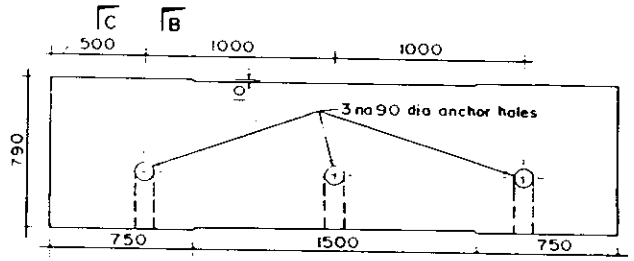
DRAWING NO. BRT/MPR/B*/008



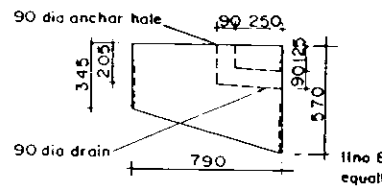
PLAN OF COUNTRY BOAT STEPS
SCALE: 1:200



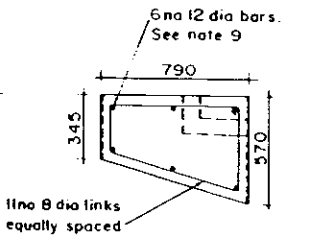
SECTION A-A
SCALE: 1:200
(See note 10)



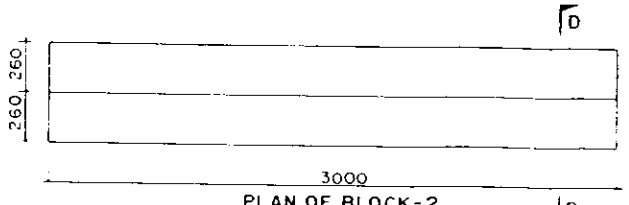
C B PLAN OF BLOCK-1
SCALE: 1:20



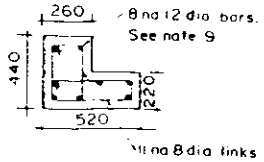
SECTION C-C
ANCHOR HOLE DETAIL
SCALE: 1:20
(For reinforcement see section B-B)



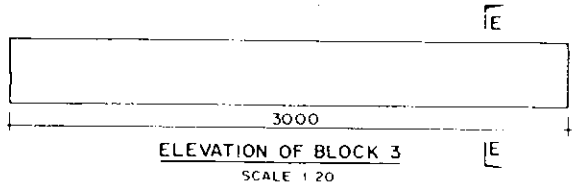
SECTION B-B
REINFORCEMENT DETAIL
SCALE: 1:20



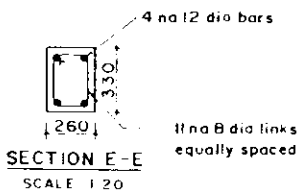
PLAN OF BLOCK-2
SCALE: 1:20



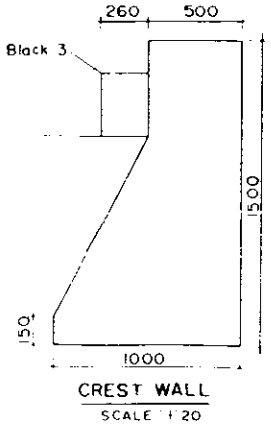
SECTION D-D
REINFORCEMENT DETAIL
SCALE: 1:20



ELEVATION OF BLOCK 3
SCALE: 1:20



SECTION E-E
SCALE: 1:20



CREST WALL
SCALE: 1:20

NOTES

1. All dimensions are in millimetres.
2. All elevations are in metres PWD datum.
3. Reinforced concrete Block-1 and Block-2 shall be precast and of class A2 concrete.
4. Block-3 shall be class A2 concrete and may be cast in situ on polythene sheet.
5. Top of Block-1 to be roughened to provide a non-slip surface.
6. Anchor holes in Block-1 shall have 90 mm dia drains as shown in the drawing. When the blocks are placed in position the invert of the drain shall be above the top surface of the adjacent lower Block 1.
7. Clear concrete cover to reinforcement shall be 50 mm.
8. Depth of water between the LWL and top of two layers of randomly placed cubic blocks at the last Block-1 below LWL shall not be less than 1000mm.
9. All reinforcement bars shall have standard hooks at their terminations and splicing shall not be permitted.
10. In section A-A the two layers of randomly placed c.c. blocks beyond the plane of the section are omitted for clarity.
11. For location of country boat ghat, see Drawing No. BRT/MPR/B✱/007.
12. Elevations and water levels are on Drawing No. BRT/MPR/B✱/003.
13. ✱: this drawing is common to all Phase 1B and Phase 1C contracts. Insert contract details prior to issue.

BANGLADESH WATER DEVELOPMENT BOARD

Sir William Halcrow & Partners Ltd
Dhaka, Bangladesh
in association with
Danish Hydraulic Institute
Engineering & Planning Consultants Ltd
Design Innovations Group

RIVER TRAINING STUDIES OF THE BRAHMAPUTRA RIVER

CONTRACT NO. B ✱

MOORING DETAILS FOR COUNTRY BOAT

DRAWN	CHECKED	APPROVED	
TRACED ASAD	SCALE 20, 1:200	DATE MAY 1995	

DRAWING NO BRT/MPR/B✱/009